FLIGHT

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The Outlook

Bravo the Fighter Command!

TWICE in four days has the *Luftwaffe* used some measure of its numerical strength in attacks on our shipping and our coasts, and on each occasion it has lost sixty or more machines in a day. Our losses in fighter machines brought down were 19 and 26, but some of these were only losses of machines, for the pilots survived and will doubtless fight again. More striking demonstrations of R.A.F. superiority in combat could hardly be desired. In particular we are filled with admiration for the calculated courage with which our pilots have always attacked, whatever the odds against them. They have fought with the object of defending their country, if possible of preventing the enemy from dropping bombs on his objective, but at any rate of inflicting such losses upon him that he will be discouraged, and if he comes again will come with less determination. With these objects in view our men have never considered the risk of losses to themselves; but such is their skill, so excellent the training which they have received, and so splendid the qualities of the machines which they fly, that their own losses have not been much more than a third of what the enemy has suffered.

The German Tactics

GERMAN tactics are significant. During the evacuation of the B.E.F. from France their bombers appeared in numbers, but failed to achieve their object of preventing the evacuation. Then from June 18 to August 4 they adopted a policy of sporadic bombing, mostly by single bombers at night, over various parts of Great Britain. These tactics gave little chance to our defences to score heavily, though on the other hand they did not, and were not likely to, cause us much damage. In a month the bombs killed 336 civilians and seriously injured 476 others, figures which are less than a normal month's casualties on our roads.

Then on Thursday, August 8, there came a change, when a mass attack was made on a convoy in the Channel. The Germans naturally want to use their possession of the French coast to stop us from steaming up and down the Channel. So they came by day. It is, we believe, a German doctrine that night bombing is too uncertain to obtain results of military importance. On that pleasant summer day the Germans sent some 400 machines against the convoy and lost 60 of them. Of this total 24 were bombers and the other 36 were escorting fighters. Their gains were two small steamers (of not much more than 1,000 tons each) sunk by bombs and seven others damaged but brought into harbour, besides the 19 R.A.F. fighter machines shot down. That result can hardly seem good business to the German High Command.

The Second Effort

DESPITE the resounding failure of that Thursday effort, another display of force was made by the *Luftwaffe* on Sunday, August 11. There were two attacks that day, one on Dover harbour and the other on Portland and Weymouth. The first succeeded in setting one barrage balloon on fire; the other resulted in minor damage to two warships from splinters, the setting on fire of an oil tank (the fire was quickly put out), and a good deal of damage to house property. There were very few civilian casualties. In these two fights, as well as in some isolated raiding elsewhere, the Germans lost 61 machines in the day, while we lost 26 fighters. The A.A. guns brought down a proportion of the raiders, and deserve full credit for that, but they played an even more useful part in driving some of the German formations off by the accuracy of their fire.

We shall probably not be exaggerating if we assume that last week, say from the Monday to the Sunday, saw the destruction of 150 German aircraft mostly with their crews, for our official figures do not include those which were still in the air when last seen, however badly they were disabled. If we also allow, this time taking a generous figure, that the total weekly output of German aircraft, both operational and trainers, is 450 a week, we must have accounted for about half the week's output of operational machines. For such a scale of loss, the damage done to our interests must be very far short of an equivalent.

A Warning

WHILE rejoicing at the success of our fighters, it would be unfair to them, as well as ungenerous, to depreciate the courage of German airmen. Mr. Duff Cooper, Minister of Information, said the other day "It is their (our pilots') almost invariable experience that when they sight the enemy, the enemy flies before them." It is the case that when Heinkel 111 bombers sight Spitfires they try, as a rule, to escape. They are quite wise to do so; they would be foolish not to do so, and in all probability they have been ordered to do so. That does not imply cowardice, but ordinary prudence, as Mr. Duff Cooper ought to know. In last week's fighting the Messerschmitts did not fly before our fighters. They fought it out and sacrificed themselves in numbers in the effort to give their bombers a chance to carry out their work. What the losses of the dive-bombers would have been without a fighter escort can only be conjectured. The Messerschmitts certainly had numbers on their side, but they must have known (they ought to know by this time) that they had quality against them. In time we hope to break the fighting spirit of the *Luftwaffe* by eliminating (or is "liquidating" the more fashionable word?) their best air crews, but at present our fighter pilots are opposed by stubborn airmen, and that makes their success all the more meritorious.

All-Clare

WHAT a pity it is that the Powers That Be could not have been persuaded a little sooner of the prestige value of keeping commercial aviation going in wartime. The recent flight by the Short flying boat *Clare* of the Airways Corporation has given our cousins on the other side a real kick. Somehow, the sight of Kelly Rogers and his merry men brought home to them better than anything else could have done the spirit of our country. The congratulations received by *The Daily Telegraph* on its enterprise in sending copies to prominent American and Canadian personages were really much more than that. They were an expression of admiration for a country which, in the midst of the greatest struggle of its tempestuous history, can spare the men and the machine for a goodwill flight to the other side of the Atlantic.

The thanks of the nation are due, not only to the crew of the flying boat, who made their landfalls with unerring accuracy in spite of wartime restrictions on aids to navigation, but also to the authorities who sanctioned the resumption of these experimental flights, and to the company which undertook the task.

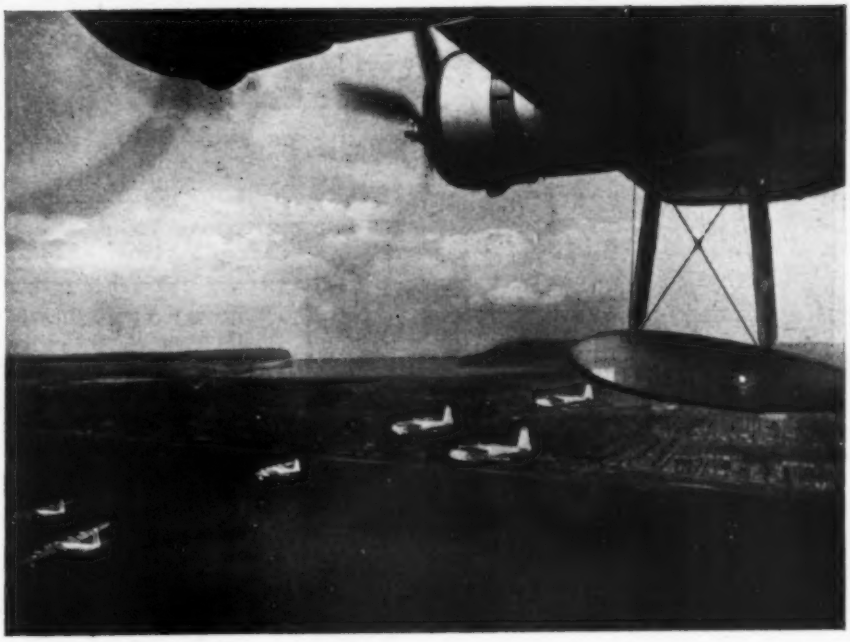
Of the flying boat itself there is little need to say more than that she is a Short with Bristol engines. In peace and war that combination has proved itself over and over again to be unbeatable

BACK IN ENGLISH WATERS

Clare, the Airways Corporation flying boat, disembarking passengers and crew after her flight to Canada and America and back. For an account of the trip, see pages 132-133.

WAR in the AIR

Two Historic Fights : 121 German Machines Down in Two Days



FROM THE ARCTIC TO ALEXANDRIA : The Short Sunderland flying boat, seen here in formation, has been in action over the North Sea, Atlantic and Mediterranean. It has attacked enemy targets with excellent results and the German fighters have learnt to respect the qualities of the air gunners and gun turrets.

MR. CHURCHILL on Saturday, August 3, issued the following warning :—

"The Prime Minister wishes it to be known that the possibility of German attempts at invasion has by no means passed away. The fact that the Germans are now putting about rumours that they do not intend an invasion should be regarded with a double dose of the suspicion which attaches to all their utterances. Our sense of growing strength and preparedness must not lead to the slightest relaxation of vigilance or moral alertness."

This, we may take it, was not issued without good reason, and we know that the authorities will not be surprised if a German attack, perhaps by sea as well as by air, is launched in force against this country in a short time. It may actually have come to pass by the time these words are published.

It is supposed, and reports from Swedish sources give some corroboration, that the Germans have been preparing and practising for an attack on Britain in the eastern end of the Baltic, where they prepared and practised for the invasion of Norway. We have not yet seen evidence that this is so, but we are on the look out, and we do not believe that enemy forces could get from the eastern Baltic to Great Britain without being spotted by our patrols, and when they are spotted they will receive the earnest attention of the Royal Navy and the Royal Air Force.

Italian Activity in Africa

OTHER things add to the probability of an early attack. The day after the Prime Minister's warning, that is on Sunday, August 4, the Italians commenced an invasion of British Somaliland, while in Libya at least two divisions were massed on the western border of Egypt. At the same time it was obvious that the Axis Powers were bringing pressure to bear on General Franco to commence an assault on Gibraltar. The policy of Hitler and Mussolini is to attack on as many sides as possible at the same time with the object of preventing reinforcement of British naval and air strength at any point. The disappearance from the Allied front of the French forces in Tunisia, Djibuti, and Syria has naturally very much altered the comparative strengths of the Allies and the Axis in Africa and round the Mediterranean. At first the local French Governors of those colonies had declared for carrying on the war, but they, or their successors, have now submitted to the orders of the Pétain Government. We must not, therefore, be surprised if our troops in Africa do not waste themselves in disputing every patch of desert along the enormous perimeter of the operations. Withdrawals will shorten our lines and lengthen those of the Italians, and in a country where roads are few and the greatest desideratum is water, such a move has obvious advantages. We know, with satisfaction, that the Italians in Libya can only receive supplies by sea and that every ship has to risk interception by our Navy and Air Force. In East Africa the Italians cannot receive any help at all from outside, and must live, so to speak, on their own fat. The R.A.F. has been sedulously attacking the liquid form of that fat, namely, oil, and every tank set on fire has meant so many fewer miles for the Italian aircraft and motorised or mechanised ground troops.

An interesting incident occurred in East Africa recently. A formation of British bombers, probably Blenheims, had raided a place called Chinele, where they duly dropped their bombs. On their way home empty, they found three Savoias attacking the station of Zeilah, in British Somaliland, and promptly attacked them. A fight between bombers and bombers is unusual. It was not stated if the British outnumbered the enemy, but in any case, if they were Blenheims, they would be quite capable of fighting enemy bombers. They shot one down, and saw black smoke pouring from the engine of another as it made off.

On the western frontier of Egypt the series of raids on the port of Tobruk seem to have taken effect. Italian maritime activity moved westwards to the port of Bardia, which in its turn became a favourite target for the R.A.F. bombers; and as that place began to grow uncomfortably warm, yet a further westward move was made to Derna, which has also become a favourite resort of our bombers. These moves mean somewhat longer flights for our machines, but they also mean that the enemy is landing his stores farther away from the point where he wants to use them. Considering the difficulties of transport in that part of the world, with Balbo's coast road as the only good means of communication, this extension of the Italian lines is a more serious matter than the additional flying which our bombers have to do.

Before leaving the Libyan front we would quote from a letter written by the leader in the epic combat of July 4 when five Gladiators attacked and shot down nine Italian

ESCORT DUTY: An Avro Anson of an Ulster squadron of the Royal Air Force Coastal Command looks after its charges in the North Atlantic. Of but medium power and performance, the Anson has, nevertheless, done an exceedingly fine job of work for the Training Command as well as its better-known coastal duties.

Fiat Cr. 42s. The officer was F/O. A. G. Worcester, and he has since been killed in a flying accident. He was leading his flight home through a thick mist, and left the rest to come low and discover their position. The haze stretched right down to the ground, and he crashed. In a letter to his mother after his great fight he wrote:—

"I wonder if your psychic gift told you what was happening between 6 and 6.15 this evening as it has about other great days in my life. For to-day, one of the greatest ambitions of my life has been fulfilled. I was involved in an air battle with the enemy for the first time. It seems that Providence went out of His way to fill my cup of joy, for it was the type of engagement which every fighter pilot dreams about and longs for but seldom gets in these days —fighter *v.* fighter in a dog-fight spread all over the sky—each man for himself. About 6 o'clock this evening I led five of our fighters into action against nine Italian fighters over their own aerodrome. The whole thing only lasted about six minutes, although it seemed like half an hour. We shot down the whole nine and I had the luck to account for four of them. Our chaps put up a wonderful show and we had no losses. I write this by the light of a candle stuck in a bottle at our landing ground a few miles from the front. It is a glorious starry night, and looking back the whole thing already seems as a dream, yet it wasn't. I remember looking down and seeing nine smoking piles on the ground and with relief counting the remaining aircraft and knowing all our boys were safe. It certainly was a colourful and amazing scene and all the more impressive with the setting sun and orange mist and anti-aircraft fire.

"Do you remember the film 'Dawn Patrol'? The atmosphere was just the same, and to add to the drama as we were sitting round our mess camp this evening an Italian pilot who had been shot down in the morning was brought in. The poor fellow was deathly white, and had obviously resigned himself to anything. We gave him a drink, some cigarettes, and some food which he wolfed, poor chap. He could not speak English, but on my asking in French, I discovered he could speak Spanish, having served in that war. I acted as interpreter between him and the boys. He had a pointed Balbo beard, dirty silk shirt, shoddy trousers, no stockings and sandals. I walked with him to his tent, saw him comfortable and gave him a packet of cigarettes. His gratitude was pathetic. I think most of these Italians do not want to fight us at all . . . .

"I am dead tired, dirty and unshaven, but otherwise in great spirits. I do hope this gets to you soon, knowing how you wait for it all the time, as any success of mine means so much to you. . . . You know how I have waited all my life for something like this, and now it has happened. I can hardly believe it. I am most grateful for the luck and opportunity that has been given me."

The Italian mainland has been left alone since the raid which flew over the Alps and bombed the aircraft works at Turin, but bases in Sardinia have been raided by the Fleet Air Arm. On August 2 Swordfish and Skuas from a carrier made a two-fold attack on the harbour and aerodrome at Cagliari in the south of the island, and the Admiralty has since issued some information about the results. Although heavy anti-aircraft fire was encountered, the attack was completely successful. Buildings, hangars and aircraft on the ground were destroyed or damaged. Bombing attacks on British ships were successfully repulsed, Skuas shooting down three enemy machines. Another was hit by A.A. fire. The crew of one Swordfish are missing, and it is feared that they have perished. A second machine made a forced landing in Sardinia and, according to the Italians, the crew have been made prisoners.

The F.A.A. at Cagliari

ONE flight of 'planes flew low to bomb the harbour and another high to attack the aerodrome. Describing the harbour raid on his return to Gibraltar, says Reuter, one of the pilots said: "The harbour was incredibly crowded. Our first load dropped into the water, but the second one disposed of two flying boats. They were there one moment but had vanished the next. At least 20 guns, as well as machine guns, were loosed off at us, but the firing was erratic. We were hit, but were not aware of the fact until we landed on our aircraft carrier. Then we found parts of the casing of a six-inch shell." "All we met," said the leader of the raid, "was a flying-boat, for which we are rather sorry. It is now fit to be under a glass case in the Kensington Museum."

The high-flying flight came in to attack at 10,000ft. and power-dived to 4,000ft. "Our first lot fell in the water," said one pilot, "the second on the sea wall, which was badly damaged, and the third on hangars full of seaplanes. Out of five hangars we left three smoking. We encountered one Italian fighter when neither of us was in a position to fire. The Italians grinned at us from 50 yards. One of my crew fired three rounds rapidly from a pistol and the Italian machine then made off. Two Italian fighters took to the air, but did not come to grips with us. In fact, they

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helped the attackers because the Archies ceased fire in order not to hit their own machines."

In the first week of August the air war in the northern area pursued its normal course—normality implying unresting activity on the part of the R.A.F. and varying degrees of enterprise on the part of the Germans. On Thursday, Aug. 1, Skuas of the Fleet Air Arm bombed a wireless station in Norway and also attacked an enemy supply ship, which was last seen listing heavily and being abandoned by her crew. The same afternoon the s.s. *Highlander* was twice attacked by enemy aircraft in the North Sea. The first German missed with his bombs and then came down to machine-gun the decks. While he was doing that the gunner on the ship hit the machine, which burst into flames and crashed into the sea 100 yards astern of the ship. Ten minutes later another German attacked and it, too, was hit by the gunner as it circled round. It lost height and its port wing struck a lifeboat at its davits, which swung the machine round and it crashed on the poop of the ship. Two men were wounded on the ship. Next morning the *Highlander* steamed into a British harbour with the wreckage of the German aeroplane on her poop. The Admiralty sent the Master a telegram of congratulation. Another ship, H.M. Trawler *Cape Finisterre*, which was sunk by air attack recently, also shot down one of the German machines. She was attacked by four, and the destruction of the first did not deter the other three. She was hit and subsequently sank.

British Bombing Raids

THE Germans grow no more humane as the war proceeds. Not long ago the Trinity House tender *Alert* was taking relief men out to a lightship when she was attacked from the air. The bombs missed, but some of the men on board were wounded by machine-gun fire. The behaviour recalls, by way of contrast, the attitude of King Louis XIV of France when at war with Britain in the 18th century. The King reprimanded the Captain of a French privateer for making prisoners of the men who had been at work on building the lighthouse and ordered the release of the prisoners for, as he said, "Their work is for the benefit of all nations; I am at war with England, not with humanity."

There were two daring daylight raids by the R.A.F. in the afternoon of Aug. 1. A strong force of Blenheims of the Coastal Command dived out of the clouds to attack Cherbourg aerodrome. Many enemy aircraft were seen on the ground and bombs were dropped among them, while hangars and defences were also attacked. There was heavy fire from the ground, but the attack was resolutely pressed home. Three of our machines were lost.

BOMBING UP: 500-lb. bombs on their special trolleys being fitted into the bomb bays prior to a raid over enemy territory. This scene is enacted hundreds of times every day.

At the same time advantage was taken of the haze that day to send a small force of bombers against aerodromes in North Holland and on the island of Schouwen.

Our bombers are still laying mines in the Baltic, which may interfere with the transports which it is supposed are preparing there for the invasion of Britain. The naval base at Kiel also continues to receive visits from our bombers. Work on the damaged *Scharnhorst*, if she is still there, must be proceeding very slowly, but she has not been specially mentioned in recent reports.

In Germany persistent attacks are constantly being made on oil refineries, as Germany depends on the production of oil from coal as a not unimportant source of fuel supply. Oil refineries is a term which would include also the plants for distilling petrol from oil. Every diminution of Germany's oil supplies is good work for our cause.

Good Formation Tells

ON Sunday, August 4, there was a very satisfactory little fight between three Blenheims of the Coastal Command and four Me 109s, in which our bombers, contrary to all theory, had much the best of things. Our success was due to keeping close formation and to the good work of our gunners. The Blenheims were patrolling the French coast when the Messerschmitts attacked them. The British pilots dived steeply in formation until they were just above the clouds. Their gunners were firing all the time, and two of the Messerschmitts broke away. One of them headed back for the French coast, low over the sea, apparently in flames. The other Messerschmitts continued to attack, but the Blenheims still kept their formation intact and brought the concentrated fire of their rear guns to bear on one of the German fighters. It is believed that this Messerschmitt also was severely damaged. The Blenheims all landed safely, and there were no casualties among the crews.

Field Marshal Göring has had a brain-wave. Remembering what a lot of trouble our leaflet raids gave to the German police, who had to pick up all the millions of leaflets for fear the German public's *moral* might be shaken by reading them, he decided to drop copies of Hitler's recent speech over Great Britain. As all our papers had published that speech almost entire, these leaflets were not likely to enlighten anybody. Some enterprising people collected copies and sold them as souvenirs, handing the proceeds over to the Red Cross. *Flight*, unfortunately, has not had a chance of securing a copy as a souvenir—not that any of our staff want to read that speech again.

Thursday's Great Battle

THE greatest air engagement up to date took place on Thursday, August 8. It took the form of a whole series of attacks on one of our convoys in the Channel, and resulted in our fighters shooting down 60 German aircraft, losing only 19 machines themselves. The first stage was naval and took place before daylight, when a number of German motor torpedo boats, known as "E boats," attacked the convoy and sank three coasting vessels with torpedoes. One "E boat" was sunk and another damaged. Then, during the morning, the turn of the *Luftwaffe* came. To begin with, a squadron of Hurricanes which had already distinguished itself in previous battles, and which we will for the purpose of this story christen "H Squadron," had twelve machines out on patrol when they found 50 Junkers dive-bombers preparing to attack the convoy, while an escort of fighters kept guard overhead. Most of the escort were Messerschmitts, but the Hurricane pilots said that they recognised some Heinkel 113 machines with them. Without hesitation the twelve Hurricanes dashed at the German masses. It was gallantry worthy of the best traditions of British fighting men. After the battle of the River Plate the Captain of the *Admiral Graf Spee* attributed his defeat to "the in-

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credible audacity" of the British cruisers. The same words might justly be applied to the attack of H Squadron. No doubt the squadron adopted the regular tactics of sending one formation to hold off the fighters while the remainder attacked the bombers. The dog fight up above resulted in the Hurricanes shooting down three Me 109s and losing two of their own number. Down below the other Hurricanes shot down six Ju 87s. This fight took place about 9 a.m.

Gains and Losses

THE second air fight began about 11.30 a.m. and lasted for an hour and a half. H Squadron was in it again, and so were other squadrons of Hurricanes and Spitfires. Finally, between 4 and 5 p.m., the Germans sent some 150 bombers and fighters against the convoy, and another fierce fight resulted. H Squadron was engaged for the third time, and in the course of the day it destroyed 21 German machines. The total German losses for the day were 24 Ju 87 dive-bombers, 27 Me 109s and nine Me 110s, making a total of 60 machines in all. We lost 19 of our fighters. Two small ships were sunk by bombs and seven more were damaged but reached harbour.

It will be noticed that the enemy lost 36 fighters and only 24 bombers, which shows the value which he is gaining from being able to use fighter escorts when operating near his bases. In the early morning battle the Messerschmitts were not able to prevent the bombers losing heavily; that is to say, heavily in proportion to the number of Hurricanes which were engaged. On the whole day this preponderance of Junkers losses over Messerschmitt losses was not maintained. We may speculate as to how many bombers our fellows would have shot down if they had not had to give much of their time to engaging the fighters.

As a demonstration of the superiority of the R.A.F. over the *Luftwaffe*, the day's work was as convincing as it well could be. The Germans have still a much greater number of machines than we have, but if they ever imagined, as they probably did, that their numbers would give them mastery of the air, that idea must have been rudely upset by Thursday's fights. When we gain superiority in numbers, as we shall do in good time, there is every reason to hope that we shall attain a real mastery in the air, which should be a great step forward to national victory.

Stories of the Fighting

HERE are some of the stories of the fighting. One of the pilots of H Squadron is a Pole, who does not speak much English. Describing his experiences in the early morning battle, "I was attacked," he said, "by three Heinkel 113s, who seemed to be working to a plan. One was flying alone and the other two as a pair. If you attack the pair the single one tries to get on your tail." He tackled the single Heinkel 113 and watched it go down smoking, though he was not able to see the final crash. The other two flew off. It was during the last battle of the afternoon that this Polish pilot got his first Messerschmitt 109.

The C.O. of H Squadron described the early morning action in these words: "We climbed to 16,000ft.," he said, "and, looking down, saw a large formation of Junkers 87s approaching from the south, with Messerschmitt 109s stepped up behind to 20,000ft. We approached unobserved out of the sun and went in to attack the rear Junkers 87s before the enemy fighters could interfere. I gave a five-seconds burst to one bomber and broke off to engage two Messerschmitt 109s. There was a dog fight. The enemy fighters, who were painted silver, were half rolling and diving and zooming in climbing turns. I fired two five-second bursts at one and saw it dive into the sea. Then I followed another up in a zoom and got him as he stalled."

A Flight Lieutenant in the same squadron managed to bring down two Junkers 87s, though his engine had stopped. "I was forced to retire owing to engine failure, but dived down on a Junkers 87," he said. "After a three- or four-seconds burst it went into an inverted dive and crashed into the sea. My engine started again, so I went after another Junkers 87 and attacked him before he was able to make his dive-bombing attack on the convoy. He dived into the sea at high speed. After this second attack my engine stopped for good and I only just got back to England."

During the midday fight a Spitfire squadron chased seven Me 109s over the Channel to the French coast and shot down six of them.

The pilot of one of the British fighters that was lost, by his last act prevented his burning machine from falling in the centre of a South-East Coast town. With black smoke pouring from it, the fighter burst into flames, and, blazing from stem to stern, looked as though it must inevitably crash into some buildings. He was rapidly losing height, but the pilot remained at his controls until the machine dived into the sea 50 yards from the shore. Motor-boats went to the spot but found no trace of the pilot's body.

Sunday's Great Fight

A SECOND equally fierce and perhaps even more successful air battle took place on Sunday, Aug. 11, in which we destroyed no fewer than 61 enemy aircraft for the loss of 26 fighter machines on our side. Though our losses were higher than on the Thursday, the Germans were even less successful in achieving their objects, and so we may count this as a more successful day. The Germans had three objectives. In the early morning they made another attack on Dover, apparently with the particular object of damaging the balloon barrage which would hamper their dive-bombers.

Actually they only shot one balloon down. It seems that the A.A. guns played the chief part in driving off this attack, actually shooting down three Messerschmitts, but Spitfires joined in and took their toll. Repeated attacks continued for some hours. Soon after 10 a.m. a German force, estimated at about 200 bombers and fighters, attacked Portland. There they did slight damage to two warships, which were hit by splinters. Weymouth was also attacked, and a good deal of damage was done to house property. An oil tank was set on fire, but it was soon extinguished. A hospital was bombed, but there were few serious casualties or deaths. There was yet another attack on a convoy off the East Anglian coast, and in the evening stray bombers were met off the East Coast, and a Dornier 17 and a Junkers 88 were destroyed.

A Spitfire Squadron

ONE Spitfire squadron fought four times in the day. When over the convoy it surprised 40 Me Jaguars (i.e., Me 110s carrying bombs), which tried to form a defensive circle, as the F.E.s used to do in the last war when attacked by Albatross fighters, but the Spitfires were too quick for them and shot down ten into the sea. The Portland fight proved the most expensive to the Germans, as there they lost about 40 machines. As usual, we only count successes when an enemy aircraft is seen to fall; those which limp away damaged may fall into the sea or may sometimes get home, but they do not enter into our calculations. We admit as losses machines which are shot down or do not return to their stations, but of these not all mean the loss of the pilot. In a proportion of cases he proves afterwards to be safe, and is available for further service.

The success of our defences, A.A. guns as well as fighter aircraft, increases our confidence about our ability to meet the invasion which may come at any moment. The Germans prefer daylight for serious attacks, and that gives us a good chance of intercepting. The more that the Germans send, the more we shall shoot down.

Topics of the Day

TRICYCLES AGAIN

"Indicator" Returns to an Old Discussion : The Effect of the War on Possible Development : A Final Advantage of the Level-Landing Gear

BY this time, had it not been for the incidence of the war, we might have seen quite a number of interesting things in the world of aviation—things which we shall no doubt see again in good time and which we may even yet see applied to military as well as to civil types and hardly in the conditions for which they were considered.

Forgetting special high-speed types, instruments to increase the safety of air travel, and slowly emerging civil machines which may yet appear either in their original or in a new guise, there were one or two items which can only be described as adaptations of existing ideas. Best known and most interesting of these was the tricycle undercarriage. Though essentially applicable to and useful for military as well as civil types, it was inevitable that experiments should tend to slow up in the rush of production. In wartime there is neither the time nor the inclination to carry on with experiments or modifications which are not absolutely essential to the success of the flying machine as an offensive and defensive weapon.

Given a few more months of consideration, there is no doubt that the tricycle principle would have proved itself to have distinct and final advantages from the military point of view—whether as a means of reducing training time, reducing the number of minor accidents in bad-weather landings, or reducing the areas required for successful take-offs and landings. But years are required for the successful application of such comparatively revolutionary ideas—and years were not available. No doubt experiments still proceed in various quarters, but the chance that we shall see the tricycle principle applied to machines in quantity production are rather remote unless this war goes on for a more or less unlimited period of time.

However, after flying most, if not all, the types which were fitted experimentally with the tricycle in this country before the war, it was decidedly interesting to have the chance of flying something really large with this type of undercarriage. Curiously enough, after such previous experience, there was nothing very new or strange about the actual landing. It was just what one might have expected. The machine was held off in the usual way until the moment arrived when the elevators could no longer hold the nose up in a more or less level attitude, and then the whole outfit simply sank on to the ground and fell gently forward on to the nose wheel.

There was nothing new in all that. What was interesting was the way in which size increased the importance of what were, in a light aeroplane, very minor disadvantages. The little experience which I have now had of the tricycle as applied to full-size aeroplanes only serves to increase the conviction which I previously held—that aeroplanes must be designed round the tricycle. That the entire machine must be thought about all over again. It is not sufficient to decide that an ordinary aeroplane shall have a three-wheeled undercarriage. Not only must the general design be reconsidered from the word "go," but such items as flaps and brakes must be specialised. If necessary, the tricycle must await the further work of designers on such items.

The Short Wheelbase

First and foremost, the track is inevitably very short. The machine is, therefore, more difficult to control, although, at least in the case of the conventional nose-wheel type of gear, it is more directionally stable both during the take-off and landing runs. The difficulty occurs at low speeds for the very good reason that corrections, by whatever means they may be made, are more marked in their effects. At the best of times the use of braking effect on one or other wheel is a primitive and unsatisfactory means of directional control. With a short wheelbase the tendency to over-correction is more marked, and this is even more exaggerated by the use of a castoring nose-wheel. A pull to one side or the other produces a natural deflection of the nose-wheel. This deflection tends to pull the nose round somewhat farther than was intended and requires an extra drag on the opposite side to correct it, since the nose-wheel must first be eased back. The result is that at the moment when the machine is actually and finally going straight again there is far too much pull still being

". . . . it was decidedly interesting to have the chance of flying something really large with this type of undercarriage." The Douglas DB-7 shown here is probably one of the largest military aeroplanes fitted with tricycle undercarriage.

applied to the opposite wheel, and the divergence is over-corrected.

The obvious answer is a steerable nose-wheel, but the stresses on the control and on the pilot's legs would be greater as the size of the machine increased. Some indirect control with an irreversible effect is needed, and even then it is doubtful if such a system would work successfully. Perhaps the trouble could be cured by the use of other steerable wheels while retaining the castoring nose-wheel. Some special system is obviously necessary, particularly as one of the minor advantages of the tricycle is that the take-off run can be started in some other direction than that finally taken. In other words, it may be useful to obtain initial speed before reaching the actual take-off point—though this often seems to me to be an advantage of little practical value. Nevertheless, precise and easy ground control is absolutely essential on any large machine.

Real Acceleration

Only with a level-landing gear does one really know acceleration and realise the enormous drag imposed on a machine during the early part of the take-off by the wings at a high incidence, and by the elevators, which are being used to their fullest extent to lift the tail. Good acceleration, however, automatically pre-supposes poor deceleration. The tricycle type is not only being landed at a somewhat higher speed, but there is absolutely nothing to stop it once it is on the ground. It is in flying attitude, with the drag at an absolute minimum.

Flaps must therefore be designed not only to have their normal lift-increasing and drag-increasing characteristics while in the air, but must also have a further position for use immediately after the touch-down, when an enormous increase in drag is required without any change in the ground trim. In other words, the flaps must not tend to lower the tail, give any excess pressure to the nose-wheel or reduce the directional stability. Rather they must help to retain the machine on its original course and offer more adhesion to the braking wheels.

Flaps at the best of times are queer things. If you design them to provide a vast excess of lift for the take-off then it is ten to one that the airflow effects are such that they cannot be used during this part of the flight. Either the down-wash lifts the tail too startlingly, or there are other and still more unpleasant effects immediately after the take-off. Here is one big advantage of the tricycle; such down-wash effects will be unimportant, and high-lift devices can be used to their best advantage while leaving the ground.

Undercarriage Loads

In a big machine, too, one begins to appreciate the tremendous stresses taken by the undercarriage, but it seems to me that the *average* load is likely to be less with the three-wheeled gear in the ordinary course of events. Whereas every landing will probably be heavier than that normal in the case of a standard type, the stresses are taken once and for all, and the machine is never subjected to the series of hammer blows which are offered when a normal type is put down carelessly. That is a matter for the technicians to work on, but apart from a plain fly-in (which the tricycle is designed to take) the loading will be natural and even, whereas with the standard type all manner of strange stresses can be applied, from tail-firsters with the consequent series of pitchings to the heavy wheeler with unpropheciable developments. The whole structure of a tricycle is bound to be heavier and the retracting gear both heavier and more complicated, but the advantages are there.

Weight and expense will be amply justified if only in the saving of unnecessary minor and major tragedies at the end of bombing raids. Tired and sometimes wounded pilots are often expected to find their aerodrome in frightful weather conditions and then to pull off a peach of a landing down a flare-path or in daylight with early morning fog to add to the troubles. Perhaps the knowledge that some kind of fair landing must still be made prevents the pilot in such conditions from giving in altogether. I don't know. But the saving in nervous strain, machines, and even in the lives of a valuable crew may be worth consideration.

INDICATOR.

U.S. COAST GUARD AIRCRAFT

An American Service Celebrates Its 150th Birthday

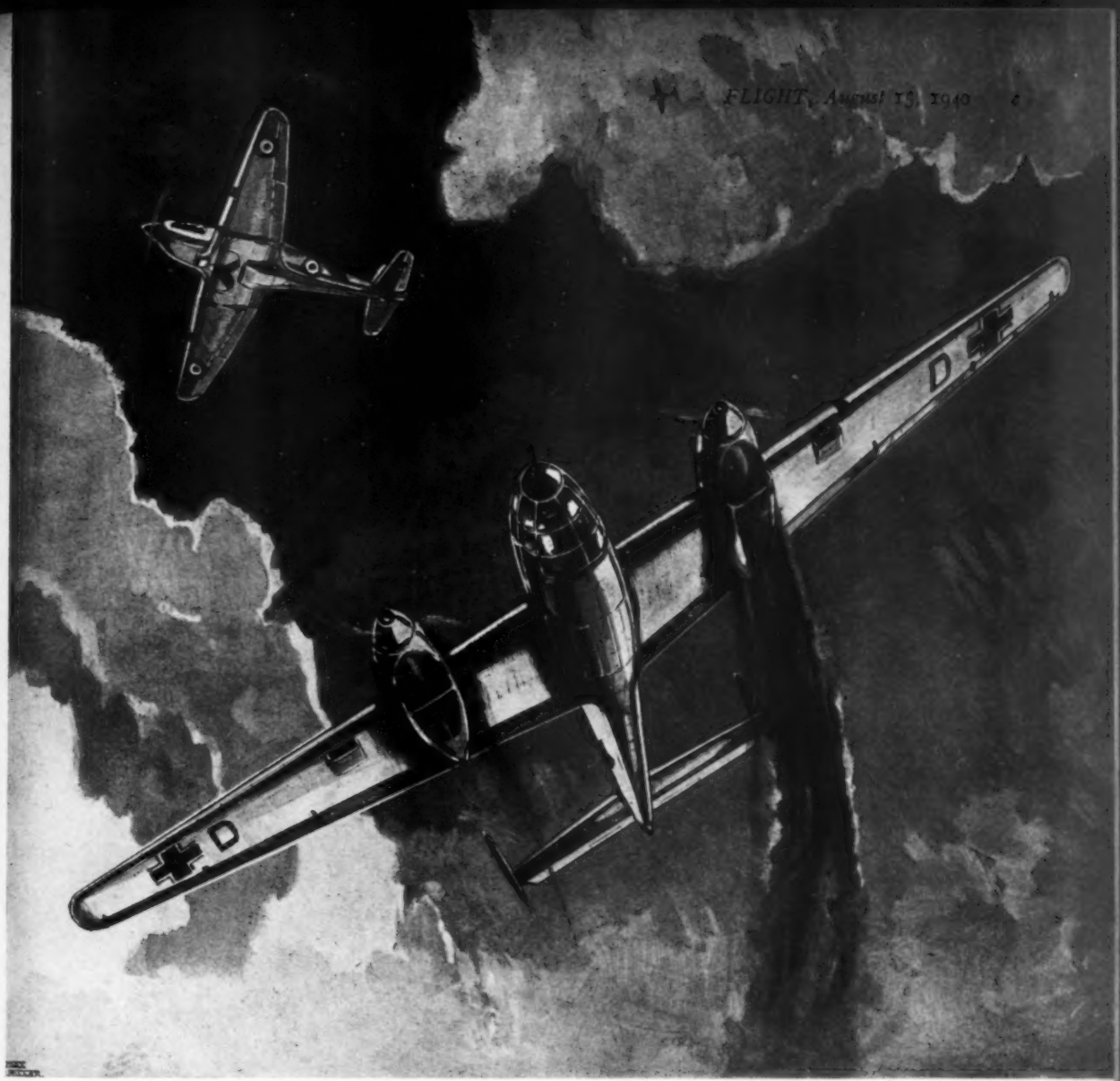
THE U.S. Coast Guard has a fleet of over sixty aircraft and even has seven of its ships fitted up to carry them, so effective are these winged guardians of the seaboard of America considered. *The Intava World* for July gives a brief history of this organisation, which probably has an all-round usefulness on humanitarian tasks greater than any other authority making use of the air. In wartime the Coast Guard takes its place in national defence, but its peacetime duties include, as well as law enforcement, the warning of off-shore fishing craft against storms, searching for lost vessels, medical aid for ships at sea (which may require the transport of patients from ship to shore), and the maintenance of an iceberg patrol.

It has duties on land also. Rescue of persons from isolated localities, survey work in connection with floods and hurricanes, fast transport of medical supplies such as serum to prevent outbreaks of disease—all these are part of its duties. In addition, a patrol of docks and anchorages is flown to observe any water pollution caused by ships illegally discharging oil.

The U.S. Coast Guard is the oldest Government maritime service and celebrates its 150th birthday this month. It started its history as the ten vessels of the United States Revenue Marine, but in 1915 was merged with the Life Saving Service to become the Coast Guard. It has had its own training establishment since 1876, but with many changes. Now its modern academy, completed in 1932, provides the personnel, whose qualifications have to be as high as those for the Army or Navy.

The aircraft fleet includes the Grumman G-21 and the Hall-Aluminum PH-3. The Grumman is a 3 or 4 seat amphibian specifically designed for coastal patrol, and is an all-metal monoplane powered with two Pratt and Whitney Wasp Juniors (400 h.p. at 5,000ft.). Its gross weight is 8,200lb. and a maximum speed of 184 m.p.h. is claimed. The amphibian undercarriage and tailwheel are both retractable manually, the former into the fuselage.

The Hall-Aluminum is larger. It is a twin-engined biplane flying boat intended for patrol and rescue, and has room for a crew of four and three or four stretcher cases. Gross weight is 16,152lb. Its two Wright Cyclones (750 h.p. at 3,200ft.) give it a maximum speed at sea level of 153 m.p.h. The hull and wing structure are of aluminium alloy, the wing and tail group being fabric-covered.



A *Flight* artist's impression of a scrap between a Hurricane and a "Jaguar."

THE MESSERSCHMITT BOMBER

AMONG the new types of German long-range bombers is the "Jaguar," the latest product of Willy Messerschmitt, whose name has hitherto been chiefly associated with single-seater fighters. The new bomber has a strong likeness to the Me110 fighter, but the transparent nose gun position is different and resembles that of the Heinkel lllK. Powered by two liquid-cooled engines (probably D.B.601s), the type has so far been used mainly over the North Sea. It seems likely, however, that we may soon see it over this country.

The "Jaguar" carries a crew of four, and the armament includes several light and heavy machine guns. On the right is seen a gunner at his station in the nose. One imagines that he would have an impression of nakedness in that glasshouse of his. The bomb-aimer's station is just out of sight at the bottom of the picture.

VARIABLE-PITCH AIRSCREWS

V.P. and Constant-speed Control

By H. N. CHARLES, B.Sc. Eng. Lond. (Hons.), A.M.I.A.E., M.S.A.E.

THE following notes are intended to be of some interest to those who have not yet had an opportunity of testing and studying the action of up-to-date variable-pitch and constant-speed airscrews.

The standard types of constant-speed airscrews of the present day do not differ in principle from the fixed-pitch airscrews of a previous generation, but the pitch of the blades is variable at will in the modern designs, and can be so controlled by a governor unit that the airscrew itself holds the engine at any desired steady r.p.m. in flight, irrespective of changes in engine power or aircraft speed over a wide range.

These actions of the governor unit do tend at first to cause some initial confusion in the mind of anyone who has been using a two-position airscrew for any length of time before trying out an airscrew with a constant-speed control, since the cockpit control no longer changes the airscrew pitch from "coarse" to "fine" in nearly such a simple and direct manner when the constant-speed control is used. Once the initial difficulties of putting the control setting to the desired positions have been overcome, however, it soon becomes evident that the new type of control is really simplicity itself in its operation, and that it represents a very definite and worth-while improvement in airscrew practice.

The title of the article includes constant-speed control because it is particularly necessary to accept the fact that "constant-speeding" is only *one* of the advantages of a modern variable-pitch design. A more complete list for a fully controllable variable-pitch airscrew would include the following functions:

(a) Acting as a fixed-pitch airscrew for testing the engine on the ground;
(b) "constant-speeding" during take-off and climb, and all manœuvres during aerobatic flight;
(c) locking the pitch in any position in the air;
(d) making it possible to control the pitch manually, quite apart from the constant-speed governor;
(e) feathering the airscrew when it is desired to stop its rotation during flight;
(f) unfeathering the airscrew gently or suddenly according to requirements;
(g) reversing the airscrew to assist non flying manœuvrability, particularly in the case of large multi-engined flying boats.

All types of modern variable-pitch airscrews possess several of the attributes in the above list, and at least one all-British make possesses all of them, from which the great advances made in airscrew technique during the last few years can be appreciated.

(a) Acting as a Fixed-pitch Airscrew

With old-fashioned fixed-pitch airscrews the state of the engine could always be readily checked by watching the rev. counter reading on the ground. Variable-pitch airscrews still have to meet this same requirement so that the engine can be properly tested before leaving the ground.

In general this requirement necessitates a fine-pitch stop being provided in the variable-pitch airscrew. This stop is generally so set that full engine r.p.m. cannot quite be attained on the ground.

By setting the cockpit control to full r.p.m. the governor unit, in its efforts to "constant-speed," will

A De Havilland Flamingo demonstrates single-engined flying with one of its Perseus XVI engines and fully feathering airscrews stopped.

"Flight" photograph.

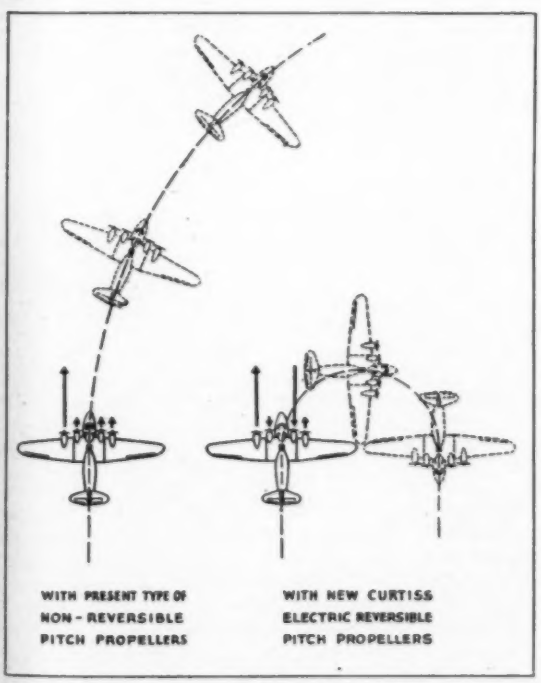
try to make the blade angle fine enough to reach full r.p.m. on the ground. This is prevented by the fine-pitch stop, and the airscrew, coming up against its fine-pitch stop, acts as a fixed-pitch airscrew for testing the engine.

To test the airscrew for "governing on the ground" the cockpit control is pulled back far enough to drop the r.p.m. This causes the blades to come away from the stop, but in that event the airscrew speed and engine r.p.m. are controlled by the governor alone, irrespective of whether the engine is quite up to standard power or not.

Airscrew with electric pitch-changing mechanism are usually so arranged that the constant-speed governor can be switched off. But even so a fine-pitch stop is still necessary to ensure that the blades always come back to the same position when testing the engine on the ground. Some variable-pitch airscrews with hydraulic pitch-changing mechanism also have a "positive fine" position on the control to over-ride the governor action. This is not essential, since the airscrew can always be arranged to go up against the fine-pitch stop in the manner described, even when the governor unit is working, and the feature is therefore frequently omitted.

(b) *Constant-speeding*

During take-off and climb, at any rate, the "constant-speed" feature is essential on modern high-speed heavily loaded aircraft. The effect varies slightly with different designs, but generally speaking the airscrews come away from the fine-pitch stop as soon as the aircraft begins to run at any appreciable speed along the ground, and the constant-speed governors then take over.



The advantages of reversible pitch airscrews shown diagrammatically. On the left is shown the turning circle of a flying boat with conventional airscrews. On the right the turning circle of the same boat, with Curtiss reversible airscrews. The inboard airscrews are in reverse pitch, and the port outboard and the starboard inboard engines are given full throttle while the other two engines are allowed to idle. The reversible airscrew can also be very useful for coming up to moorings.

Once off the ground, "take-off" r.p.m. are reduced to climbing r.p.m. by merely moving the airscrew cockpit control as required, the throttle being then used to adjust the boost to the desired figure.

The extent to which the governor may be called upon to make rapid pitch changes in the air depends mainly upon how suddenly the throttle is opened during aerobatics, and how violent the aerobatics themselves are. This will depend upon the type of aircraft on which the airscrew has been installed, but as a general statement it is fair to say that modern constant-speed airscrew designs are possible which can control engine r.p.m. within perfectly safe limits, no matter how great the aerobatic qualities of the machine may be. For use on very large machines, on which aerobatics are not possible, a much lower rate of pitch change meets all requirements, but on small machines of high manœuvrability a high rate of pitch change is essential.

(c) *Locking the Pitch*

With some designs of variable-pitch and constant-speed airscrews it is possible to lock the pitch at any time when in the air. The principal use of this feature is in connection with flying for long distances on a set course, and for landing with the airscrews locked.

When the constant-speed control is in operation, a steady falling off in power from any one engine of a multi-engined aircraft is difficult to detect, particularly if the machine is being flown by a gyro pilot. Although the engine power is slowly failing, the revolutions will remain constant because of the governor action. The only indication that something is slowly going wrong with the engine is indirect evidence, such as a gradual reduction of airspeed due to reduced total power.

If all airscrews are locked for flights of this type, and carefully synchronised by a manually operated pitch control, any loss of power in one engine can be immediately noticed from the rev counter readings, and steps can be taken to attempt to find out the cause of the occurrence.

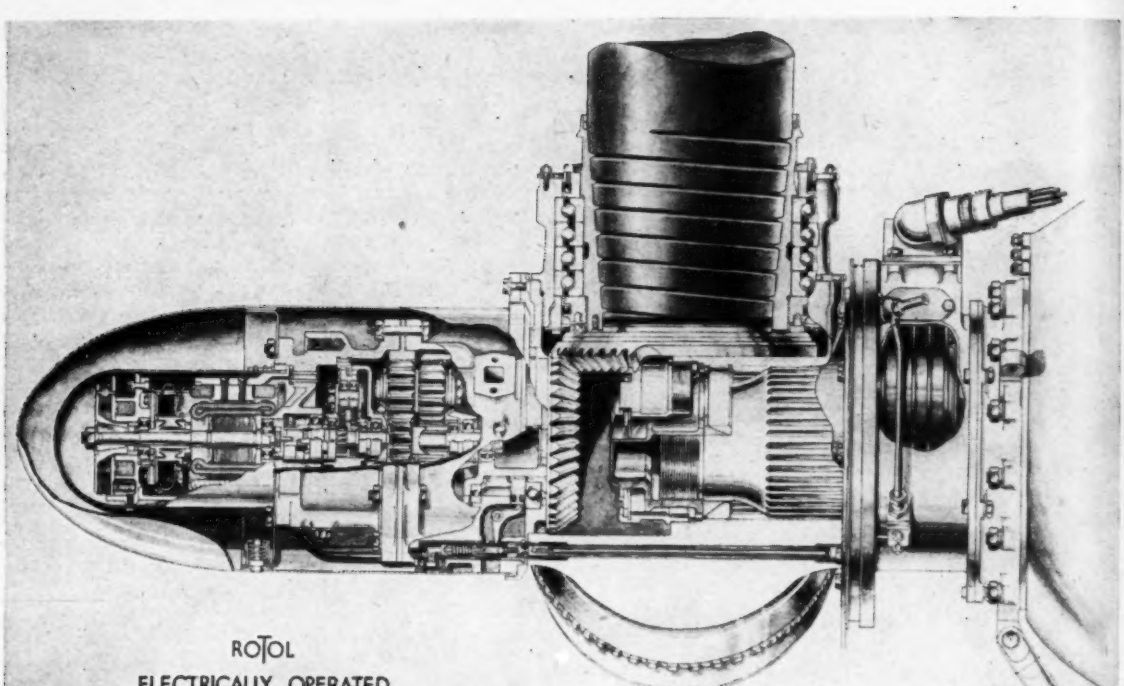
A second useful point gained by the ability to lock the airscrews is that, on a large machine, landing may sometimes be easier when the airscrews are locked. This is due to the fact that the response of the machine to small touches of throttle is slightly more direct than it is when the airscrews are changing their pitch. Before landing with the airscrews locked it is, of course, an easy matter to adjust the pitch to suit landing conditions.

(d) *Controlling Pitch Manually*

This feature is referred to above in respect of some of its uses. It comprises a switch or control by means of which the airscrew pitch can be changed as desired without the assistance of the constant-speed governor. In modern types it is usual so to arrange matters that this control operates slowly, so that exact adjustments of pitch may be made before the airscrew is switched off or locked.

(e) *Feathering the Airscrew*

Should a power unit in a multi-engined aircraft suddenly fail for any reason, it is a great advantage to be able to feather the airscrew. When "windmilling," the airscrew offers considerable drag at a point where it is not wanted, and the damage may easily be of such a nature that it is best to stop the engine. In the "fully feathered" position the airscrew blades are turned round until the average torque exerted by the windmilling blades becomes nearly zero, and the air-



A sectioned view of the new Rotol electrically operated variable-pitch airscrew.

screw ceases to rotate the engine. It will be seen, on looking at any such airscrew, that the blades have now taken up an angle such that one part of the blade area is trying to rotate the airscrew in one direction, and another part tends to rotate it in the opposite direction. The combined result is an out-of-balance couple in each direction insufficient to move the engine. The drag of the airscrew is now much smaller than it would be if it were windmilling, because the resultant velocity of the air in relation to all parts of the airscrew is reduced to a figure equal to the forward speed of the aircraft itself, which is the minimum possible in the circumstances. A further reduction of drag is due to the fact that all parts of the blade are at angles to the relative wind which correspond to low drag coefficients.

Owing to this reduction in drag, the feathered airscrew greatly increases the range of a multi-engined aircraft when one engine has broken down. Thereby it improves the chances of the machine getting home.

The actual pitch-changing mechanism of the airscrew may be hydraulically or electrically operated, but provided the above conditions are met, the method of operation is purely a matter of design convenience, the effect in the "fully feathered" position being always the same. Generally speaking, some auxiliary source of power, such as a battery and electric motor driving an oil pump, or a motor generator type of voltage booster, is used to feather the airscrew.

(f) *Unfeathering the Airscrew*

Under certain conditions it may be desirable to unfeather the airscrew in flight, and all modern designs of feathering airscrews provide a control for this purpose. In principle, the operation of unfeathering is merely the reverse of the feathering operation already described. Slow unfeathering is a feature of some types of airscrew so that a cold engine can be set going again as gently as possible.

Naturally an airscrew which can be locked in any position has definite advantages in this respect, since the engine can be left running slowly while the aircraft is still flying at normal cruising speed. The pitch of the blades is then readjusted at intervals, so that the engine warms up and takes its load gradually instead of suddenly, as would be the case if the airscrew were violently unfeathered.

(g) *Reversing the Airscrew*

Flying boat technique in the U.S.A. has already established the advantages of a "reversible" variable-pitch airscrew for controlling taxying on the water under adverse conditions of wind and tide. Designers of variable-pitch airscrews in this country are naturally offering this same feature in their up-to-date designs.

The most promising type of pitch control, so far as this feature is concerned, is at present the electric type, in which a voltage booster similar to the one used for feathering the airscrew can also be adapted for reversing it when required.

General

It must be admitted that all these features have increased the complication of airscrew construction far beyond what it used to be in the days of simple fixed-pitch screws. Such complication is, however, more superficial than real when the increased range of requirements is taken into consideration.

For the future it can only be said that, no matter what complicated requirements may be asked for, our airscrew designers are ready to meet them in good time.

As time goes by it is possible that the apparatus itself may be gradually simplified and lightened without detracting from its ability to meet all requirements, but at the moment the airscrew is rather like the undercarriage—it started life very simply and then grew up.

Air Strategy—XV

AIR BLOCKADE—V

Britain's Air Blockade Must Reach East Germany, Says

CAPTAIN NORMAN MACMILLAN, M.C., A.F.C.

THE weapon of blockade is only of full value if it cuts all sources of supply. In this respect it is open to doubt if Britain's sea blockade is as complete as it was in the war of 1914-1918. For then, Germany was more completely ringed about on land. Her eastern frontiers were largely closed frontiers; even if her arms could penetrate into the Middle East, into the country which was then called Mesopotamia and is now called Iraq, they stopped at the shores of the Persian Gulf, and, shortly after, far up the great rivers that flow into the Gulf. All the Mediterranean, except a narrow strip in the extreme east, was denied to Germany and her Allies. To them the vast hinterland of Russia and all the Far East were shut off.

How different things are to-day! All the mainland of Europe is open to Germany, much of it under Germany's direct domination; Russia is not cut off; in the central and eastern basins of the Mediterranean the positions have been reversed.

One of the Pan-German dreams of the 1914 epoch was the conquest of the Islamic world. That dream in recent years has brightened the sleeping hours of Mussolini. But the Islamic world which rejected German domination in 1918 is no more enamoured of Mussolini as an overlord. However, taking things by and large, the Islamic world of to-day believes itself to be in less danger than it was in 1914-1918. This is probably why it has not yet taken a really active part in the present campaign. It takes a threat to the Koran rather than a threat to a tribal community to rouse the Islamic world to the consolidation needed for a modern Jihad. So far the religious war has not threatened the Koran; it has been an anti-Roman Catholic and an anti-Judaic war which has been waged by Hitler, and into which he has impressed Mussolini and now passive Pétain.

Respect for Islam

Hitherto Hitler has been far-sighted enough to keep his hands off Islam, while Mussolini in recent years has courted the believers of the Koran. It may be the knowledge that it will not pay to sweep a third religion against him, a religion whose followers are fighters, and fanatical about their freedom to worship the Prophet in their own way, which has kept Hitler from pushing down into the Near East, from smashing through the Balkans. With Islam Hitler must steer clear of the persecution he has handed out to Jews, Catholics and Protestants if he is to make any overtures to the Moslem world; there are not so many more great religions which he can treat superciliously without rousing nearly all mankind against the two partners of the company of Axis, Ltd., and their subsidiary Nippon. The Italo-German boast of a population of some 130,000,000 may seem a grand boast in Western Europe, but it is a puny part of the world's total population.

The mere fact that Hitler and Mussolini have hesitated to antagonise the world of Islam is significant, for it is proof that they realise that there is a limitation to the projects which they can set themselves simultaneously to attain. But woe betide the world of Islam if these two fanatical anti-religionists should conquer Britain. Their mechanised hordes would sweep over the Islamic world, and against them all the bravery of the followers of the Prophet would not avail. To-day, Britain is the unacknowledged champion of the Islam world's freedom. Yet the frontiers of the lands in which the followers of the Prophet live are in many places open to the passage of men (and goods) who will work to attempt the overthrow of Britain. It is time that the truth was made known to the Believers so that they will know that their religion may be endangered by this war which has come like a cloud of darkness over the western world. They could help by means of passive measures, even if they are unwilling to risk their patrimony upon what they consider (so far) to be a white man's war. They do not realise that regalism is one of the principles over which this war is being fought. Let them know it. It will help the blockade. For blockade can be greatly strengthened by the personal resistance of individuals; it is the weapon which has been so widely used in recent times—by the suffragettes in England, by the disciples of Ghandi in their civil disobedience campaign in India; it is a weapon which could stir the bowels of the armies of Mussolini; it has already begun, faintly, to function in the region of Ethiopa with the return to north-eastern Africa of Haile Selassie.

Africa and the Near East

Britain's power to shut off the Axis partners from the Islamic world will be decided in Egypt and the Near East, in the Sudan, in Somaliland. And there, since Italy came into the war on June 10, the Axis partners have been subjected to blockade. But the peculiar position of *status quo* in the French colonial possessions enables Germany and Italy to turn their full forces against the British Empire's forces while they leave the question of the destiny of French colonies until a later date. They know full well that if we win this war the French colonies will not be administered by either Germany or Italy, and that the Italian "Empire" (so facilely created out of the conquest by gas and bombs of a foe without such refinements in war weapons) will cease to be an Empire by the return of that unhappy land to non-Italian rule, whatever else Italy may have to do as well by way of compensation for her record in the European tangle since the time of her rapprochement with Germany.

They know full well that if they win this war the French colonies are theirs for the asking. So it is now or never for the two dictators. They must knock us out before they can begin to crow. To trouble about the French colonies too much at present would dissipate their forces, forces which they need to continue the struggle against Britain which they now face. And it is for that reason that we must apply the powers of blockade to the uttermost limit of our power, without scruple, for this war in which we are engaged is a war to the end, a struggle to the death—and we must win.

Italy's attack upon British Somaliland is a strategic move. It must have been framed with the triple object

AIR BLOCKADE (CONTINUED)

of heartening the home Italians, endeavouring to deflect our strength from the defence of Egypt, and striking a blow at British prestige among the native races. Whatever happens in Somaliland cannot affect the sea blockade which the British Navy maintains. Nor can that desert country of 68,000 square miles, whose chief products are cattle, sheep, goats, hides, skins and gum, do much to help our enemies. But the Somalis are a Mohammedan people; that is important. The Hitlerite repression of religion shoul' be spread far and wide among the followers of Mahomet.

Here is the best description of Somaliland I have read. It was written by (then) Squadron Leader J. L. Vachell, M.C., who gave a lecture before the R.U.S.I. dealing with a flight from Aden to Addis Abbaba at the time of the coronation of Haile Selassie. Squadron Leader Vachell was then in command of No. 8 Squadron at Aden. "Somaliland," he wrote, "generally is a barren waste covered in most parts by thorn bushes ten to twelve feet high, and dotted with ant-heaps. The country is entirely featureless, and even the watercourses are dry except in the rains. . . . About half-way between Hargeisa and Jig Jiga, somewhere near the frontier, which is very indefinite, the country changes abruptly from the scrub-covered plain to rolling grass land, somewhat reminiscent of Salisbury Plain."

The population of Somaliland is about 350,000. And the best defence of that barren country, albeit an indirect one, is a resolute scheme for the tightening of the blockade about Italy by air attacks on objectives on Italian soil.

Spirit of the Army

Before I pass on to what I have to say about the process of applying blockade still more severely, I want to say one thing which has proved to be the most heartening matter I have come across for weeks. It is that those specimens of Britain's new army I have come in contact with while moving about the country during the past few days have not failed to impress me with their guts; I know that they have an indomitable spirit which is the same as the spirit of the men who came through Mons and the first battle of Ypres in 1914 in those dark days when the Germans first tried, then without success, to reach the Channel Ports. I knew those men who survived Mons and that first battle of Ypres. I lived among them and fought with them. And the spirit they possessed, their capacity to laugh at the Germans, is alive again among the fellows who came back from Dunkirk.

The British Expeditionary Force in Belgium was not defeated. The Germans never broke through it. They broke through the Belgians on one side and the French on the other side, but never through the British Army. And the Germans know it. It must be a disturbing thought to Hitler that his massed tanks and armoured vehicles, his sidecars and infantry by the hundred thousand, could not break through the British front, and far from breaking the spirit of the troops who returned to this country, have simply made them laugh at Jerry. Although we have had to withdraw our troops from the Continent, I believe we have left the German troops who met the B.E.F. with the feeling that the British have a sense of superiority over the Germans, and that is more than half the battle of the spirit which, with adequate material support, triumphs in the end.

The same spirit prevails in the R.A.F. and in the Navy. And until that spirit is broken—which will never happen—the "Jerry," who was in the last war the "Hun," cannot win. And so while we have Jerry with the knowledge that the British soldier considers himself superior to the German soldier, let us use every resource we possess to smash down the spirit of the German by getting at him from every angle, and above all by getting at him where he thinks he is safe—in the area of Eastern Germany.

A Missed Opportunity

We missed a golden opportunity to operate from French soil, partly because of the political policy of the period and partly because our squadrons in the R.A.F. were not sufficiently mobile. The aeroplanes themselves were mobile, but all the things that pertained to their operation—the ground crews, the maintenance organisation, the supply side of the job—were too slow and had to pass through the same channels of movement as the Army units. Now we must make up for that failure to seize the opportunity presented. And that can be done only by increasing the range of the aircraft we are using and those we are going to use in the near future.

If it has not already been done steps should at once be taken to secure additional range, without sacrifice of bomb load, by means of assisted take-off. In time of war, economy is thrown to the winds. There is no need, therefore, to consider money. The most expensive way may prove to be the cheapest in the end if it will finish the war sooner.

The simplest way to provide assisted take-off is to use gravity. It has been customary for long-range flights to use special runways for the purpose. Why should not military aircraft use special runways for their purpose? The labour can be found. The cost of construction need not be considered. The fact that machines might have to take off singly would not matter. For bombers it would have to be a night job anyway. It would be undesirable to send bombers hundreds of miles across German occupied territory by day. The losses might be too great, prove the operation uneconomical, and unnecessarily trying to the personnel engaged.

Night Bombing

If the tasks are made more dangerous, the crews will have to be given more rest; for the running of risks consciously produces a sense of strain, which causes fatigue to develop quicker. Reduce the strain caused by risk, and fatigue is less marked, and moreover is of a kind from which the individual recovers more rapidly. Indeed, I think that the continuous running of known risks can, after a time, produce in some individuals a result not so very different from that produced by sudden shock. And the best way to cut out the risk factor in the operations of bombers is obviously to make the bombing operations principally night operations. For proof of that one need only examine carefully the comparative losses suffered by German aircraft which have operated when British day fighters could get at them and the losses suffered by German aircraft which have operated at night. And the mere fact that night bombing interferes with the sleep of people in the areas under attack is of itself a good war weapon, for lack of sleep quickly undermines the constitution and complacency of most individuals. So, as the job must be principally a night job, the aircraft would take off singly anyhow.

I know, of course, that my suggestion of a special

AIR BLOCKADE (CONTINUED)

runway will immediately raise a howl. How long would a special runway last? Wouldn't it be bombed to glory almost before it was finished? Well, if it were to be so bombed that it would take bombers away from other targets, it would be better for the enemy bombers to bomb runways than to bomb factories and docks and houses, and lots of other things.

But need the runway be so very easily bombed? The arts of camouflage could surely be used to protect it, with a dummy runway clearly visible and the real runway well camouflaged. Wouldn't that upset many a pilot who came over to bomb the runway? The dummy could be blown sky high time after time and rebuilt during the day, and at night for that matter; it would be a useful decoy for enemy air activity. And, except for the moment of actual use, the special runway method of launching would fit in with the need for aircraft dispersion as a safeguard from bombing, for counter aerodrome bombing has become a regular feature of the present war.

Again, there are the composite aircraft and the refuelling-in-the-air methods of increasing range. Have they been tried out in this war? If not, why haven't they been tried?

It was the Norwegian campaign which first demanded a great increase in range from the operating squadrons of the R.A.F. The conditions of that campaign were not envisaged in advance. They were sprung on this country as an unpleasant actuality, and among the surprises, the operation of aircraft without suitable bases close to the operating army was a new feature in war to the British Staff. There seemed not to be any suitable means to overcome that operational limitation. The possibilities of increasing range offered by various methods ought to have been studied and provision made for some aircraft to have special long-range facilities, even if it were just to provide against the unforeseen possibility which does crop up in war.

That need for ultra-long range aircraft is even more urgent to-day. There are the big geographical split between our forces in Great Britain and our forces in the Middle East, and the greater distances to reach Eastern Germany and Italy to be bridged. All call for aircraft with somewhat similar qualities.

It is true that we have been giving German targets a pretty good tousing during recent weeks. But almost all those targets lie in the western half of Germany—seldom, if ever, east of a line running through Rostock, Gotha, Stuttgart. That is an area representing roughly a third of the pre-Anschluss-with-Austria Germany, and only a fraction of the Greater Germany which existed before the Norwegian attack developed. East of that line lie the great industrial areas, and areas containing many targets of military importance, in the true Germany, in Austria, Czechoslovakia and Poland. To make our air blockade of Germany complete it is essential to possess and operate aircraft over those areas. The Fleet Air Arm cannot help, for its relatively short-range aircraft cannot be taken near enough to the shores of the Continent to do more than can our bombers shore-based in the United Kingdom. What we need are bombers with a much greater range, obtained without sacrifice of bomb load. They are needed urgently even as temporary types pending the delivery of others with still greater range and bomb load. Everything needed to permit them to operate should be put in hand, so that the present air operations can be extended to the targets which lie beyond our present areas of attack. What some of those targets are I propose to discuss in some detail in my next article.

OIL and WAR

Some Oil Figures as They Affect the Present Struggle

THOUGH it has always been very important, the oil aspect of the war has been thrown into high relief by recent events. Germany's conquests have brought her ample iron resources in France and in Spain, and in France she has captured the greatest aluminium-producing country in the world. But she still needs to control oil wells if she is to wage a long war.

The articles which have been written about oil have been numerous, and many of them have demonstrated conclusively—or at any rate to the journalists' own satisfaction—that "the Nazis can't last."

That does not mean that this article is going to strike a pessimistic note and claim that it is being courageous in the interests of truth in so doing. It is just not going to "strike a note" at all. For the first conclusion the writer came to when he started investigating oil consumption, production and export among some official statistics was that no conclusion could be reached.

A bad confession with which to start an article, but since the investigation was to seek out truth, one must put down truth as it is found. The most reliable figures which were obtainable had to admit themselves uncertain on many things. League of Nations statistics on annual production had disagreements of perhaps 15 per cent. when compared with similar figures from other sources. And on the production of oil from coal, uncertainties of perhaps 100 per cent. were admitted.

So if readers seek in this article some estimate of the length of time for which war can be waged—by either side—they had better turn over the page, for no such attempt at forecasting will be made. The article seeks only to paint the broad outlines of the oil picture as it was before the war, so that a background is available against which to see the significance of some of the present happenings.

Quantities

What does the word "oil" mean? It does not mean petrol nor does it mean lubricating oil. A better word instead of "oil" would be "petroleum products," for, as quoted in papers, "oil" may be taken to include all the following: aviation fuels, motor spirits, fuel oils, lubricating oils and crude oil. In short, all liquid products from the oil refineries and wells and the products from hydrogenation plants producing petrol from coal.

Statistics are given in barrels, tons of 2,240lb. or metric tonnes of 1,000 kilograms (2,204lb.). A barrel contains 42 U.S. gallons, which gallon is different from the imperial gallon, being 0.83 (or five-sixths) of it. So a barrel contains 35 imperial gallons.

The weight per gallon of petroleum products varies considerably, petrol being about 7.5lb., while lubricating oil weighs about 9lb. Consequently, the number of barrels to the ton of oil (meaning petroleum products) varies, but 7.4 is an average figure.

Though "oil" does not necessarily mean "fuel for internal combustion engines," to compare oil figures is certainly to obtain relative figures of the fuel available, since in these days of chemical marvels, all sorts of natural petroleum from the heavy oils to the natural gases can be converted into fuels

for internal combustion engines, whether spark or compression ignition, carburettor or injection types, by processes known in the chemists' jargon by such words as "polymerisation," "cracking" or "cutting back."

In the figures given in this article, only the ton (2,240lb.) and the imperial gallon will be used.

Oil Production and Consumption

Where is the oil of the world produced? Before the war, production figures were of the order of magnitude given in Table I. The corresponding consumption figure of countries with which we are concerned is also set down to give a picture of how much they had to import or how much surplus was available for export.

TABLE I
OIL FIGURES FOR SOME IMPORTANT COUNTRIES

	Production (Millions of Tons per Year of Petroleum Products)	Consumption
U.S.A.	162.0	138.0
Mexico	5.5	
South America	37.0	
Iran and Iraq	14.5	
Rumania	6.5	1.9
Poland	0.5	
Russia	28.0?	27.0?
Dutch East Indies ...	7.5	
British Isles	0.2	9.8
France	0.07	6.9
Germany	2.0?	7.9
Italy	0.01	3.5
Japan	0.2	3.9

The first thing which strikes one on looking at the table is that the belligerent nations, listed at the bottom of the list, are fighting this war on other nations' oil! Their home productions, except for Germany's, are negligible.

All the figures have some doubt about them, and the particularly doubtful ones are so indicated. But they still give a background for the wartime oil picture. U.S. production and consumption tower above all others. Russia and South America are also important, as is the Iran and Iraq total.

Rumania produces much and consumes about a quarter of it, leaving 4.6 million tons available for export. Germany for her peacetime needs had to import about 6 million tons, so Rumania would be unable to supply such needs alone.

The German figure of 2 million tons is made up of 0.5 natural oil and 1.5 petrol from coal, produced by the hydrogenation plants. Figures on this latter quantity are admittedly vague and the one given is more than a year out of date. What is certain is that actual production is now considerably greater than this, unless. . . Unless what? Unless the R.A.F. have destroyed some of the plants.

The capitulation of France has improved the German oil situation by giving her coal with which to feed the hydrogenation plants. Of course, such coal has to be transported there, and our Air Force may be able to seriously hamper that.

Exports

Turning now to export figures to see which nation supplies which, it is only possible in this short article to examine a few of the exports most significant to the present conflict.

In 1938 Rumania sent 1.0 million tons to Germany and 3.5 to all other countries. The 1938 Russian figures show that only a very small amount, 0.1 million tons, went to Germany and only 1.2 to all other countries. Russia is not a great oil exporting country and consumes most of what she produces. Of course, if she is willing to cut down home consumption she would then have large quantities to send to Germany.

Table II gives an analysis of U.S. exports.

TABLE II. U.S. ANNUAL EXPORTS (Thousands of Tons)

U.S. Exports to—	Gasoline	Gas plus Fuel Oil	Lubricating Oil	Crude Oil	Total
Japan	148	1,120	41	2,880	4,189
British Isles	1,150	540	338	13	2,041
All other countries ...	4,150	4,250	880	7,550	16,830
				Total Annual Export ...	23,060

It is evident that Japan gets 4.2 million tons per year from U.S.A. This is Japan's total annual consumption, so U.S.A. holds a formidable trump in the Pacific card game. This total is useful in evaluating the importance of the recent ban imposed on the export of aviation petrol to countries outside North and South America.

It must be noted that it is not the export of oil which is banned, but of aviation spirit. If it was oil, Japan would be deprived of all her supplies and precipitate military action to seize other sources (such as the Dutch East Indies) might well be the outcome. The ban may not mean much in quantity; something less than 0.15 million tons per year. And Japan will no doubt make aviation fuel out of her oil supplies.

Japan may have suspected the American ban in advance, for last April it was reported that she was making efforts at self-sufficiency in high octane fuel by hydrogenation of the Fushin mine products. Also, she made a contract with Mexico for the supply of 0.3 million tons of oil.

But the ban will undoubtedly cause her to direct her gaze very strongly on the Dutch East Indies, with a view to acquisition or at least control. And who knows but what the exiled Dutch Government might not go out there, since that is the most important Dutch possession? The extent to which Japan will be allowed to obtain Dutch oil may well be an index of the extent to which the present Governments of the democratic nations are prepared to help on, or at least acquiesce in, the designs of an aggressive Fascist State.

It is reassuring to know that no arrangements for the supply of oil to Japan have been made by the British Government, and no such arrangements are under discussion. Mr. Hugh Dalton, Minister of Economic Warfare, gave this assurance recently in a Parliamentary reply. It is hoped that this attitude will continue; we want no more Burma Road "appeasements."

Britain, as well as Japan, loses by the American ban. Most of the Japanese imports are in the form of crude oil, whereas ours are mainly gasoline, 1.15 million tons per year. Our loss will be something less than this, but, with the freedom of the seas, the amount can be made up from other sources.

What is significant is that Japan, as an aggressor, can be held in the hollow of the hand of world opinion. That is, world opinion *if* it could be translated into economic action to cut off Japan's oil supply. She is powerless to make war, as her oil supply can be cut off entirely, a fact which we should remember if we are ever able to rebuild the League of Nations and produce a more genuine edifice than the hollow sham into which the political trickery of Governments converted the fist structure, despite the peoples' will for peace.

Blitzkrieg Figures

Germany's peacetime consumption of 7.9 million tons per year is equivalent to 21,600 tons per day. What is wartime consumption?

That difficult question cannot be answered with one figure, for this war is not steady. Lull periods are interspersed with periods of intense activity. (To call a period in which only 7 or 10 enemy aircraft are shot down each day a "lull" seems perhaps a misnomer, but everything is relative, particularly in war.)

Consider only the petrol used by aircraft on a day of raiding when a total of something like 400 enemy aeroplanes appear round our coasts. Broad generalisations must be made to arrive at a rough figure of total consumption. About half would be single-engined and half twin-engined, and each engine would be between 1,000 and 1,200 h.p. On the trip across petrol would be conserved by flying slowly, probably not more than half-power. During the inevitable battle, full power would be used frequently, so that one might generalise at 75 per cent. power.

This gives 55 and 110 gallons per hour for the two types. Allowing 3 hours in the air during the day, this gives 100,000 gallons used for 400 aircraft on the raid. This weighs 360 tons, a very small fraction of the 21,600 tons of petroleum products used per day in peacetime. Of course, much more flying must go on in addition to that required for the raiding. There must be training, reconnaissance, communication and transport flying all going constantly. And the civil consumption of petroleum must also continue, although no doubt on a reduced scale.

If an air attack as a prelude to an invasion attempt were to be made on this country the consumption would be of a totally different order. Not 400 aeroplanes, but probably 4,000, would be in use. This estimate envisages something like 3,000 raiders in the air at once, with 1,000 on enemy territory doing "behind the lines" work carrying up ammunition, fuel and personnel to the advanced aerodromes from which the take-off would be made and to which aircraft would return for refuelling and rearming.

The time in the air would be longer than 3 hours and might easily be 5 hours per day. The consumption per day then becomes 6,000 tons. When it is remembered that all this is high-octane fuel (87 and 100), the daily consumption becomes impressive and undoubtedly could not be kept up for very long.

But for how long? That is not known. It depends on the amount stored in Germany before the war, the rate of output of petrol from coal, the stored petrol obtained by the conquests of Denmark, Norway, Holland, Belgium and France, and the subsequent destruction wrought by bombing. And none of these are known.

ONE MILLION MILES

An Account by the C.O. of a Hudson Squadron

The following talk, broadcast recently by the C.O. of the Squadron, was of particular interest, and we have felt that it deserves to be read by those who did not have an opportunity to hear the B.B.C. Broadcast

I AM the commanding officer of a squadron which has just completed a million miles of flying in Hudson aircraft. A million miles is a long way—about four times the distance between the earth and the moon. Indeed, for most of our flying time we might have been on our way to the moon for all that we saw of Mother Earth.

We clocked up our millionth mile quite quietly. It happened the other night when we had a number of aircraft out over the North Sea. After they came back we logged up the mileage, and found we were well over the million mark. Incidentally, we've used up enough petrol in those million miles to send a fleet of 400 family cars right round the world.

Our work is general reconnaissance—known in the Service as "G.R."—and we are a unit of the Coastal Command of the Royal Air Force. A reconnaissance really means going somewhere to see what is there. But while that is the essence of our job, there is actually a great deal more to it than that. For instance, we do a lot of bombing, and, when we run into enemy aircraft, we have to be fighters as well.

Unspectacular

I would like to tell you first something about our day-to-day work, then our aircraft, and finally about the men who compose our squadron.

I'm not going to try to shoot a line about hair-raising exploits in which our squadron has played a part—not because we haven't had plenty, but because that would be putting such incidents in a false perspective. Our work is not spectacular in the main. It is a hard, plodding routine of patrols. Every day, in sunshine, rain or snow, we go out over the North Sea to find out what's happening on the other side. And the data have been invaluable.—ED.]

With the long days of summer we put in plenty of flying hours, but winter, of course, is the biggest test. Think of a bare aerodrome in the bleak darkness of a frigid morning, a bitter wind whistling, and perhaps ice on the ground. Pilots, navigators, air-gunners and wireless operator stagger and slither to their aircraft, laden like Father Christmases with their bulky navigation bags, parachutes, flying kit, Thermos flasks, packets of sandwiches, pigeon baskets, and what-nots.

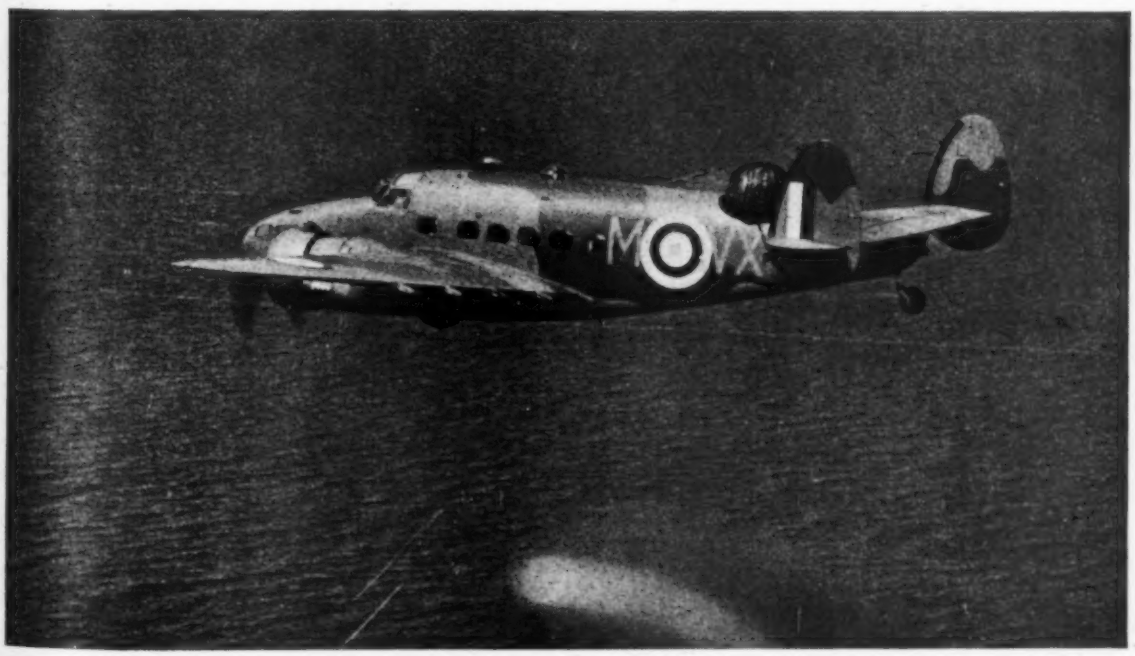
Towards the Rising Sun

Flying towards the rising sun, it may be that the navigator has just enough light to see the white horses on the grey sea as he flies full-length in the nose of the aircraft, calculating wind, drift, speed and position. The engines drone on for a couple of hours before the coast of Norway comes into view, or is found hidden in cloud or mist.

It isn't uncommon for the crew never to see land in six or seven hours of flying, although they may be so close to the mountains of the Norwegian coast as to be in danger of running into them. If visibility permits, they go into the fjords to take photographs, spot shipping and note anti-aircraft positions and aerodrome sites. Such information is of the greatest importance to Coastal Command, and many a fruitful bombing raid has been made possible by the preliminary reports from my squadron.

In the early part of the war the squadron did a good deal of U-boat hunting. There was scarcely a pilot who had not had a crack at one or more, and our total bag of enemy submarines is quite impressive.

Even if a U-boat sees us coming and crash-dives as fast as it can, it may still be within reach of our bombs. They



"Every day, in sunshine, rain or snow, we go out over the North Sea to find out what's happening on the other side." A Hudson on general reconnaissance.

are timed to explode beneath the surface of the sea. Then a shuddering and a disturbance of the water, and masses of dark brown oil coming up. These tell what has happened in the sea below. Other U-boats, which we caught by surprise on the surface, proved easy prey. Some of my pilots have seen their heavy bombs burst right on the hulls. Now, of course, there aren't so many U-boats about.

Now that Germany threatens to invade this country from Norway, our work has become even more vital. If Germany should ever attempt a mass crossing of the North Sea, my crews may well be the first British subjects to find it out. It might be on their reports that the whole of our anti-invasion system of defence would spring into operation.

Please don't think for a moment that a reconnaissance, say, of the North Sea or Norwegian coast is just a question of flying over there, taking a few photographs, making observations, and flying back. I wish it were as simple as that. But the Germans have established a very excellent system of coast defences, specially designed to keep our aircraft from doing the jobs we want them to do.

The wireless operator signals with an Aldis lamp to the other aircraft of the formation.

So we have to look out for such hazards as enemy fighters patrolling the coast and anti-aircraft fire which is of an accuracy not to be sneezed at. It is on such occasions that we use our Hudsons as fighters. To match an aircraft built for reconnaissance work against a modern fighter is rather like putting a retired boxing champion against the newest holder of the title. The fighters have an advantage over us in speed, but we carry pretty useful armament, and our big aircraft can take an enormous amount of punishment.

You would be surprised if you could see the condition of some aircraft which our pilots bring home. One of my Pilot Officers—who, by the way, has just received the D.F.C.—is making quite a habit of bringing back what one might describe as a bundle of shell holes held together by pieces of fuselage. I was aghast when I saw the holes in his last two efforts. You could crawl through the gashes in the wings and petrol tanks. In one case the undercarriage folded up as he landed. In the other, although it stayed in position, one tyre was shot to pieces and made the aircraft sink dangerously.

Admirable for Reconnaissance

There's no doubt about it, our Hudsons are first-class aircraft for the job of reconnaissance. They have far more room in them than the average Service machine; indeed, there's the same internal space as in the civil counterpart, the Lockheed 14 airliner, in which some of you have probably flown before the war. There is a row of windows in each side of the cabin, a folding bed, hot and cold air regulator—in fact, every modern convenience. The seats, of course, have been taken out, and there is a gun turret in the tail.

"They are all grand types, and I should like to make special mention . . . . . of the wireless operators."

The operational performance, too, is exceptionally good. The fact that we use these landplanes so much for long reconnaissance over the sea speaks for itself. Nobody ever worries about engine failure, which used to cause so much anxiety in the last war. A typical remark was made by one of my pilots as he taxied in the other day after a long trip. He turned to his navigator and said, "You'd think these blinking engines would go on turning over for ever."

And now I'll tell you a little about the lads who do this work. They are the advance scouts of our defence system, and they accept gladly the risks of the scout—the danger of running into enemy forces and the prospect of lone fights with the odds against you, where you know that if you survive the fight you have a long slog back, perhaps damaged, over the sea to your base.

There is little glamour in our work. It is rather like the Northern patrols of the Navy—loneliness, monotony, danger of dirty weather. But it is

(*Concluded at foot of page* 134).

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

VISIBLE VORTICES

The Exhaust as a Potential Producer

THE importance of the exhaust as a potential cloud producer seems to be rather neglected, though it was certainly mentioned in your article of July 18th.

The amount of water vapour which a cubic foot of air can contain at − 30 deg. C. without condensing into a cloud is about a tenth of a grain. At + 30 deg. C. it is 130 times as great. A little added water vapour can, therefore, easily saturate air which is at a low temperature and high relative humidity. Changes of pressure only affect this in so far as they cause changes of temperature.

An engine giving 800 h.p. will, by burning the hydrogen of its fuel, produce about 430 lb. of water vapour per hour or, say, 840 grains per second. There are many ways of seeing what this means, but as it is enough to saturate and bring to the condensation point 84,000 cu. ft. of air per second if this air starts at − 30 deg. C. and 90 per cent. relative humidity, it would seem that one does not have to look much farther for the cause of those persistent streaks which may remain visible for an hour. Those streaks, which, after persisting for some time, gradually turn into a cirro-cumulus cloud, seem to indicate that the air was already saturated before the passage of the aeroplane. At their smallest they seem to be about one wing span in diameter.

Since the air in the wake of an aeroplane has a vortical motion, the cloud naturally partakes of it. A factor operating against cloud formation is the emission of heat from the engine which locally raises the capacity of the air to retain uncondensed water vapour. Presumably these persistent trails would occur more frequently but for this factor. After all, the steam from a locomotive gives some indication of how these things go. It remains uncondensed and invisible when the air is warm, and becomes increasingly persistent when the temperature is low and the air can be more easily saturated. The emission of water vapour from the locomotive is quite twenty times that of the aero engine, and so the vapour is condensed to visible cloud when this would be quite impossible with the aero engine.

So far as propeller and wing tip trails are concerned, there does not seem to be much evidence that they persist for more than a second or so, and this is also what might be expected, for while the circulation of air can give rise to changes of pressure and therefore of temperature, it makes no contribution to the stock of water vapour in any stratum of air, as does the exhaust. It may be supposed that a wing tip vortex, especially if it is intense, will have a region of reduced pressure in the centre of whirl, and the consequent local drop of temperature can cause condensation which is quickly re-evaporated if the relative humidity is below 100 per cent. It is just conceivable that a persistent trail from the wing tip might be obtained when passing through fully saturated air in which no condensation had yet occurred, but it seems unlikely, and in any case the exhaust would be condensing in such air.

The above considerations seem to agree with the results of observation of both wing tip trails and exhaust trails.

Hatfield. C. C. WALKER.

Observations from Close Quarters

I HAVE read with interest several articles and letters which have appeared in *Flight* on the subject of cloud formation by aircraft.

While flying in formation, and in practice dog fights, I have observed from close quarters some interesting facts.

Wing-tip trails are, I think, the most easily explained of these phenomena: If a machine is flying in air which is nearly saturated (i.e., just below cumulus or strato cumulus) it may leave areas of reduced pressure which will cause a corresponding reduction in temperature and a visible cloud. I have found that when pulling out of a fast dive in these conditions or when applying full aileron the increased induced drag which results from high loading, high speed and high angle of incidence causes a very marked region of low pressure at the centre of the tip vortices (due, I think, to the centrifugal effect of the swiftly rotating vortices leaving a partial vacuum at the centre). It has been suggested that the reduction in pressure was at the outside of the vortex due to the higher speed of flow there, but the stream of vapour appears to start at a point about a foot or two behind the tip before widening out, and shows very little rotational movement; this seems to prove that the vapour forms at the centre and not at the outside of the vortex (the trail is altogether different from the clearly marked vortices which are left when an aeroplane or sailplane flies through thick smoke).

These tip streamers last only a second or two and then only when in some highly loaded turn or other manœuvre.

The cause of the very distinct white trails which appear above 15,000ft. and usually much higher still is the presence of super-cooled water droplets in the atmosphere which freeze on contact with any fast moving cold object, as aptly described in last week's *Flight* by P/O. P. F. Dunham, F.R.Met.S. This trail is composed of very finely divided ice crystals and is most usually formed by the propeller or propellers, but can be produced by the whole wing, since I have seen a Spitfire leaving a flat trail corresponding in width to the span of the machine. I suggest that the rainbow effect witnessed by Mr. R. G. Bull, of Thame, Oxon, was caused by the fact that the ice crystals left in an "artificial" cirrus would be more finely divided and less opaque than the crystals in the adjacent cirrus which have formed slowly and naturally; ice crystals above a cumulo-nimbus often give a similar rainbow effect, due to the fact that they are frozen droplets, well scattered, unlike normal cirrus.

I have on several occasions completely "removed" small cumulus clouds which had passed the "waxing stage" and were on the "wane" by diving through them several times. In this way a cloud which would normally take an hour to disperse can be dispersed in five minutes or less. The reason would be, I suppose, merely that any stirring up or mixing will accelerate any physical process already in action in the cloud.

Similarly an aircraft can cut a path through a thin cloud, leaving a blue "lane" with clearly marked vortices on each side.

Sailplane pilots have frequently reported thermals and even cumulus of their own making. One enthusiast was circling a cornfield which should obviously provide a thermal but which apparently refused to do so until he had descended low enough to stir up the hot air over and in the field and "unstick" it. He was then carried to four thousand feet or so where a cumulus formed around him as he circled.

I would be very pleased to see an article in *Flight* written by some "met. genius" such as Mr. Phillip Wills, whose knowledge of the weather, particularly in connection with flying, should produce an enlightening answer to these questions which have so far only been "theorised" or guessed at.

H. L. GREENSHIELDS, Sub-Lieut., R.N.V.R.

Revealed by Searchlights

JUNE 30, when your correspondent D. W. Palmer observed a visible vortex trail near Bristol, was (for me) a date of still greater significance: it was my first holiday since the invasion of the Netherlands. Consequently I happened to be lying on my back in a receptive mood on a near-by hillside, and was able to watch the phenomenon from beginning to end.

The only important observation I can add is that the trail was definitely *below* the upper cloud level. It was shaped like a great horseshoe, and the apex passed under, and not through, the big cloud that was there. So if any meteorologist can tell us how high the upper clouds were that day, we shall have an upper limit to the trail's altitude.

The lower clouds were cumulus, which, as every sailplane pilot knows, means an unstable atmosphere and consequently a temperature drop of at least 5-6 deg. F. for every thousand feet of height. So even on a summer's day it would be very cold indeed around 25,000ft. I can remember reaching freezing point (recorded by dashboard thermometer in an open cockpit) at only 5,000ft. during a soaring flight on a sunny, but unstable, day in spring.

Have visible vortex trails ever been observed at night? Yesterday (July 26) I saw what might have been one crossing an otherwise clear patch of sky near Bristol shortly before midnight. It was visible whenever a searchlight beam crossed it, and appeared to stretch in the direction in which the noise of an aeroplane was receding. Slight thunder an hour or two later indicated that on this occasion also the upper air was abnormally cold. In such cases might it not be worth while for the searchlights to follow the trail along in the hope of finding an aeroplane at the end of it?

Bristol. KEITH TURNER.

OFF FOR AMERICA *Clare*, "on the step," about to take-off from the South Coast base.

TRANS-ATLANTIC AGAIN

Resumption of Last Year's Flights

THE first direct trans-Atlantic crossing of 1940 from the British Isles to the North American continent was made on August 3-4. The flying-boat *Clare*, Captain J. C. Kelly Rogers, made a perfect take-off from the home terminal in the presence of Sir Archibald Sinclair, Secretary for Air, the Hon. Clive Pearson, chairman, and the Hon. Walter L. Runciman, director-general, of the British Overseas Airways Corporation.

By the engineers and operational staff, and indeed by the crew themselves, this flight was regarded rather as a continuation of the service which went regularly with mails during last August and September, than as the historic occasion which it undoubtedly was. The wartime headquarters of the British Overseas Airways flying-boat fleet had a peace-time air of bustle and preparation. The commander and navigator were in close conference with meteorological officials on the best route to be flown. Baggage and passengers were being weighed, parcels and newspapers addressed, in fact all the hundred and one details of routine activity were being seen to. Out in the bay the big boat was lying at its moorings, with men aboard making the final adjustments.

(Left to right) Mr. J. L. Burgess (radio), Capt. E. Rotherham (2nd. capt.), Capt. Kelly Rogers (commander), Capt. E. R. B. White (navigator) and Mr. C. E. Wilcockson (radio).

Captain Kelly Rogers is the pilot who brought the marooned *Corsair* back from the Belgian Congo last January. It was just a year to the very day since he had taken *Caribou* across the Atlantic on the first flight of the British airmail service to North America. Captain Edward Rotherham, the second pilot, was making his first crossing. The navigating officer was Captain E. R. B. White. Of the two radio officers, C. E. Wilcockson and J. L. Burgess, the latter made the trip in *Caribou* with Captain Rogers a year ago.

Clare was previously named *Australia* and was intended for service at the other side of the world on the trans-Tasman route. Punctually to the minute scheduled for the take-off, her engines started up and racing parallel with her as she gathered speed was a launch bearing the Secretary of State for Air. From the control cabin the commander waved a hand—and *Clare* had taken the air in just under half a minute. She gained height, turned, came back over the Minister's launch, and set her course west.

Leaving from the South Coast on August 3, *Clare* flew to Foynes and left there at 7.42 p.m. (B.S.T.). The crossing to Botwood was completed at 11.48 a.m. on August 4, an elapsed time of 16hr. 06 min. Botwood was left at 1.05 p.m. and Montreal reached at 8.10 p.m. After spending two hours there, the flight to New York was resumed and this last leg of the journey covered by 12.40. (All times B.S.T.).

Landing at the terminal on the south coast last Saturday afternoon, *Clare* completed her return crossing "without incident," as Captain Kelly Rogers said when he disembarked with the four other members of the crew. There were six passengers, of whom Sir

STRICTLY UTILITARIAN. A view of the pilots' cockpit on *Clare*.

AT REST AGAIN. After the return crossing, *Clare* goes to moorings again.

Frederick Phillips and Mr. T. K. Bewley were British. The other four were American pilots, one of whom, Mr. L. S. King, said they were under contract to the British Overseas Airways Corporation to ferry aircraft from the production line to squadrons. (The Corporation handles the organisation work of the Air Transport Auxiliary, the body charged with this duty.)

But Mr. King's next statement did not confirm this, as he said that they were informed that they would be directly responsible to Lord Beaverbrook's organisation (which is the Ministry of Aircraft Production and which is concerned with the delivery of the bombers over the Atlantic). With Mr. G. W. Moraga, he had just left commercial aviation in California. The other two, Messrs. A. A. Crane and F. W. O'Hanlon, were instructors in the C.A.B. pilot training scheme. All had over 2,000 hours to their credit. Surprisingly, they travelled without passports and were held by the security police until a 'phone call to London obtained their release.

Technical Features

In the prevailing fashion of wartime camouflage, *Clare* looked drab as she lay at her moorings after her long flight. With nothing shining about her—even her airscrews were painted a dull black—it was easy to forget the precision work that had gone to her making. Her exterior was more suitable for a coal hulk than for a conqueror of the Atlantic, and it was only with an effort of mind that one recalled the engine fits, correct to "half-a-thou," and the fact that the airscrews were balanced to so minute a degree that when they are painted the paint must be applied evenly.

The navigator's dome projecting from the upper part of the hull could be seen, this being a feature of long-range aircraft which depend on astronomical navigation. Of moulded transparent plastic, the dome is about two feet high and three feet in diameter, and enables the navigator to obtain an unrestricted view to use his sextant.

Discussing the flight with Capt. Kelly Rogers are Mr. T. K. Bewley and Sir Frederick Phillips.

Another noticeable feature was that all four exhaust pipes were taken from the collecting rings into the leading edge of the wing before ending in a short vertical stack which discharged the exhaust above the wing. And the air-intakes under the engine cowlings had small screens in front of them (no doubt the enrichment of mixture due to an engulfed seagull might have surprising consequences).

The departure was made from the flying boat base at La Guardia Field, New York, at 3 p.m. New York time on Thursday afternoon, August 8, and the flight to Montreal took 2 hours. Next day the Montreal-Botwood stage was flown in 5½hr. and after a stay there the Atlantic crossing of 1,730 sea miles (1,990 land miles) was flown overnight. The elapsed time on this stage was 12hr. 20min. giving a speed of 140 knots (161 m.p.h.) The courteous but rather uncommunicative crew seemed to indicate that there was nothing to speak about on the flight, but as one said, "We flew over icebergs near Newfoundland." Though no details could be given of radio communication, this was "satisfactory."

Clare is one of the "strengthened C class" boats, that is, she is the same size as the "C class" but can be loaded up to 48,000lb. for ordinary take-off instead of the 40,500 of that class. If later refuelled in the air, this strengthened class is capable of carrying 53,000lb. gross. *Clare's* present empty weight is 30,395lb.

Captain Rogers described the La Guardia Field airport as "magnificent," and said that there are already 240 scheduled arrivals and departures each day. (It would seem that this must be about the capacity of the airport since one arrival or departure each five minutes for 16 hours only adds up to 172. In fact, one would think that it had more than it could deal with comfortably already.) The boat carried a letter from Mayor La Guardia, of New York, to Sir William Coxen, Lord Mayor of London, as well as mail and some freight, While at the New York base, the boat aroused great and friendly interest and was placed under a very strong police guard to ensure its adequate protection.

Cuttings of U.S. papers describing *Clare's* arrival were carried back by the crew. They indicated that on the trip across three passengers were carried, Mr. C. R. Fairey, Mr. Joshua Cunliffe and Col. W. J. Donovan, who is emissary for Mr. Frank Knox, U.S. Secretary for the Navy, and had arrived in this country in July. Messrs. Fairey and Cunliffe went to Boucherville, Quebec.

HERE and THERE

Four Americans who came over on the flying boat *Clare* to serve Britain as ferry pilots. Left to right: F. W. O'Hanlon, G. W. Moraga, L. S. King, A. A. Crane.

Dismissal of Men from Factories

QUESTIONS have been asked in the House about the alleged dismissal without notice of 350 experienced men from the aircraft factory at Castle Bromwich. It was stated that the same thing had happened at the Morris and the Ford works. A report has been called for by the Ministry of Labour.

Australian Air Disaster

FOUR of Australia's most prominent public men met their deaths on August 12, when a Lockheed Hudson crashed near Canberra. Three of them were Cabinet Ministers and the fourth, Sir Cyril Brudenell White, the Chief of the Army General Staff. The three Ministers were Mr. J. V. Fairbairn, Minister for Air; Brigadier G. A. Street, Minister for the Army; and Sir Henry Gullet Vice-President of the Executive Council. Two secretaries and the crew of four were killed also. Apparently with engine trouble, the aeroplane crashed in a small clearing and caught fire. It could not be approached for half an hour, after which time all the bodies were unrecognisable.

Gifts for Aircraft

GIFTS for aircraft continue to pour in and now total £2,600,000. Mr. Garfield Weston's gift of £100,000 to replace the sixteen fighters lost in the first of the two recent big Channel battles is the biggest, but there are other substantial ones also. No less welcome and representing just as much, or perhaps more, sacrifice are the smaller donations which are far too numerous to mention.

The Province of Sind has made a second gift of £7,500, Mr. A. A. Ralli has given £5,000, the City of Worcester has collected £10,000, as has the City of Portsmouth, also. And Lord Beaverbrook has himself contributed £100 to the Newsagents' Fund.

Funds which have been opened for the purpose are as diverse as they are numerous. There is a fund in the Central Provinces of India, and the Bombay Aeroplane Fund, as well as the Dorothy Spitfire, Baltic Exchange, Spitfire over Wales, Mombasa, Gleaner of Jamaica, and Gaumont-British Funds. They will all add their quota.

Trans-Atlantic Double Century

PAN-AMERICAN must be congratulated on running its regular passenger service across the Atlantic successfully for 200 times since it was started in May, 1939. On these trips they have carried 2,600 passengers, which figure does not include any single-stage passengers. Mail has totalled over 300,000 lb., which is something like 10,000,000 letters.

During the last four months, of the 846 passengers carried 50 were children under twelve years of age and 150 were women. A two-months-old baby and an 88-year-old lady were among the passengers. No doubt many of these passengers were forced to leave by the events of the war.

Record Repairs

OVERSEAS AIRWAYS is playing its part on the military side of the war effort. Hundreds of its specialised engineering staff have been lent to the Ministry of Aircraft Production for repair work of which they have long and unique experience. At various centres they are engaged night and day on these vital activities, and to-day Captain F. R. Walker, Service Engineering Director of the Corporation, received the following telegram from Lord Beaverbrook:—

"It is with much appreciation of all your efforts that I send you this message of congratulations on the part you have taken in giving us a record week in engine repairs.—BEAVERBROOK."

As an instance of the work that is being done, the other week Coastal Command had two Short Sunderlands which were in urgent need of a complete overhaul. A call was put through to the home flying boat base of the Corporation. The aircraft were to come over at once; a thorough job must be done; they must be returned in six weeks.

Six *days* later the Overseas Airways' engineers telephoned the Coastal Command saying that they could collect. The overhaul was complete.

Pan-American's Plans

PAN-AMERICAN is seeking more expansion and has filed an application with the Civil Aeronautics Board for a route from South America to the west coast of Africa and thence along the coast down to Capetown. The company's four-motored Boeing Clippers would be used, and the route would probably be from New York to Puerto Rico in the West Indies. From there the Atlantic crossing to Bolama, Portuguese Guinea, on the west coast of Africa, would be made.

An alternative route is a possibility. This would call at Para and Natal, both in Brazil, making the crossing from the latter.

For a twice-weekly service between New York and Bolama the annual cost is estimated at $3,520,000, from which should be subtracted $1,316,000 to be derived from passengers and freight, leaving $2,204,000 to be made up by U.S. mail payment.

ONE MILLION MILES (Continued from page 130)

vital work and the men of my squadron and other squadrons who do similar work include some of the most experienced pilots and navigators in the Royal Air Force. They have hundreds of hours of war flying to their credit, and many of them have been out on more than a hundred long-range operational flights.

They are all grand types, and I should like to make special mention of the Sergeant Pilots and also of the wireless operators and air gunners, and the ground staff who are an indispensable part of the squadron.

At nights when I go down to the aerodrome, waiting for the aircraft to come back from the sea, I often think of those in my squadron who have not returned. Their work has gone to build up our first million miles. I know they would wish us luck as we go forward to our second million miles.

SERVICE AVIATION

Royal Air Force Official Announcements

Trinidad Training Scheme

THE Trinidad Flying Club is to train pilots for the R.A.F., and the local Government has agreed to pay for the cost of the scheme. Recruiting will commence almost immediately.

Pupils will receive about 20 hours of flying training, and men who appear likely to become good pilots will then complete their training with the R.A.F. The scheme is for pilots only.

Trinidad is very air-war-minded; the people have already subscribed £50,000 for the purchase of aircraft for the R.A.F.

Southern Rhodesian Contingent

THE first contingent of airmen from Southern Rhodesia has arrived in this country. They will form the technical and maintenance personnel of the Rhodesian bomber and fighter squadrons to be formed in this country.

Mr. Lanigan O'Keefe, High Commissioner for Southern Rhodesia, welcomed the men at the Scottish port at which they arrived. He pointed out that considerable numbers of Rhodesians were already in service with our forces, and five pilots had already won the D.F.C. fighting with the Royal Air Force.

Czech Airmen Reviewed

DR. BENES, President of the Czechoslovakian Republic, visited a fighter station and a bomber station during last week to review squadrons of Czech airmen who have arrived in England since the capitulation of France. Most of them, under the impression that France would fight on, had flown their machines to Morocco. They were brought to this country by the British Navy.

Some of them have seen considerable service with the French and have been responsible for a large proportion of the total of 102 machines shot down by Czecho-Slovak pilots. One has 14 to his credit and another 8.

Later in the week Dr. Benes visited a station in the Technical Training Command and was met by the Commanding Officer of the unit and Air Marshal Sir William Mitchell, Inspector-General of the Royal Air Force.

Public School Recruiting

DURING the term just ended R.A.F. officers have visited the public schools to give advice to senior boys who have an interest in flying. Qualities required for pilots and air crews have been explained, together with the methods of entry, schedule of training and the prospects of gaining a commission.

Over seventy schools were visited, and since May 267 boys have been interviewed and a large number selected. In addition 338 priority entry certificates were issued to members of O.T.C.s and air training sections who had passed their post-certificate A course. Many of these new "old boys" are already commencing their training.

Foreign Badges in R.A.F.

DISTINGUISHING badges have been approved for wear by Belgian and Czechoslovakian personnel serving in the Royal Air Force. The arm badge for officers consists of the word Belgium in $\frac{5}{16}$in. letters or Czechoslovakia in $\frac{3}{8}$in. letters embroidered in light blue silk, in an arc, on a background of blue-grey melton cloth.

On the greatcoat and service jacket it will be worn on both sleeves with the centre of the badge $1\frac{1}{2}$in. below the top of the sleeve seam. It will also be worn on both sleeves of the raincoat, the lowest points of the badge being $1\frac{1}{4}$in above the upper edge of the sleeve strap and symmetrically above it.

The arm badge for airmen will be worn on both sleeves of jacket and greatcoat below the eagle arm badge.

Prisoners of War

THE following is the latest list of R.A.F. prisoners in enemy hands. Received from German sources.

P/O. Hanlon, Ottawa, Sqn. Ldr Kennedy, Capetown, Sgt. Remnant, Acton, W.3 (all three shot down near Lenwig, Denmark, or Lenvik, Norway). Flt. Lt. H. J. Rowe, Shepperton, Middx.; A/C.1 J. A. Webster, Liverpool; Sgt. C. H Loane, Sunderland; Sgt. J. A. Lucke, Weston, Middx.; A/C.1 R. R. Shuttleworth, Ilford; P/O. Drinney, address not known (wounded); P/O. C. C. Jackson, Croydon; A/C.2 J. V. Foster, Taunton, Somerset; A/C.2 G. Snowball, New Silksworth; Sgt. W. H. Eden, Winnipeg; Sgt. C. Webb (West?), Much Wenlock, Shropshire; P/O. J. W. P. Perkin, St. Agnes, Cornwall; P/O. R. A. Willis, St. Thom, Canada; Sgt. C. H. Scanlon, West Meath; Sgt. J. Gilmour, Middlesbrough; P/O. B. A. Davidson, N. W. Calgary, Alberta; Sgt. R. J. Fiske, Abingdon, Berks.; Sgt. K. A. R. McArthur, East Letchworth, Hertfordshire.

WELL EARNED: Air Marshal Sir C. F. A. Portal, K.C.B., D.S.O., congratulating Sgt. Gamble after decorating him with the D.F.M. at one of the Bomber Stations in the Midlands.

Awards

APPOINTED A COMPANION OF THE DISTINGUISHED SERVICE ORDER.

Sqn. Ldr. C. G. Lott, D.F.C. Since June 1st this officer has led his squadron on operational patrols over Dunkirk, Amiens and Abbeville and other parts of enemy occupied territory. In July, as leader of a section of Hurricanes, he pressed home an attack in adverse weather conditions against six Messerschmitt 110's. During the combat Sqn. Ldr. Lott's aircraft was badly hit, but despite an injury which eventually necessitated the removal of an eye, he brought his aircraft to within three miles of the base before he was compelled to abandon it. He has personally destroyed two enemy aircraft and possibly another. This officer has displayed outstanding leadership and an intense desire to engage the enemy. Sqn. Ldr. Lott enlisted in the R.A.F. in 1922 as a boy entrant and remustered as an aircraft apprentice in 1924. By 1928 he had become a sergeant pilot, receiving his commission in 1933. He was awarded the D.F.C. in May last.

FLYING VISIT: Mr. Winston Churchill disembarks from the D. H. Flamingo which carried him during his recent tour of the coast defences. The Flamingo is now used considerably for communications work.

MEDAL, MILITARY DIVISION, ORDER OF BRITISH EMPIRE FOR GALLANTRY.

F/O. A. H H. Tollemache, A.A.F., P./O. E. D. Parker R.A.F.V.R. F/O. Tollemache was pilot of an aircraft which on March 11th, 1940, crashed and burst into flames while landing. F/O. Tollemache was thrown clear, but returned to try and rescue a passenger who was trapped. In spite of the intense conflagration he persisted in his efforts until driven off with his clothes blazing. His injuries nearly cost him his life. Had he not made his gallant, but unavailing attempt at rescue he would probably have escaped almost unscathed.

On the night of June 8th, P/O. Parker was first pilot of a bomber, the port engine of which failed. He raised the undercarriage and tried to fly on. Failing to maintain height he "felt" the aircraft into the nearest field in darkness. The aircraft crashed and burst into flames. P/O. Parker jumped out, but finding the wireless operator lying stunned under the burning wreckage he returned and carried the man to a place of safety. When one of the 500lb. bombs in the wreckage exploded P/O. Parker threw the wireless operator to the ground, thus saving his life. P/O. Parker displayed exceptional coolness and courage in the face of extreme danger.

BAR TO DISTINGUISHED FLYING CROSS.

Flt. Lt. A. G. Malan, D.F.C. Since the end of May this officer has continued to lead his flight, and on many occasions the squadron, in numerous successful engagements against the enemy. During the Dunkirk operations he shot down three enemy aircraft and assisted in destroying three more. In June, during a night attack by enemy aircraft, he shot down two Heinkel 111s. His magnificent leadership, skill, and courage have been largely responsible for the many successes obtained by his squadron.

DISTINGUISHED FLYING CROSS.

Sqn. Ldr. J. Worrall. This officer's splendid leadership has been reflected in the work of his squadron which has now destroyed forty-three enemy aircraft and possibly a further twenty-two. In July, 1940, he led his squadron in a successful attack against a superior number of enemy aircraft, and assisted in destroying three of the enemy force. Sqn. Ldr. Worrall has displayed great skill, courage and leadership.

SERVICE AVIATION (CONTINUED)

P/O. J F. Swift. Since January this officer has taken part in twenty-eight raids against the enemy. One night in July he carried out an attack on the railway marshalling yard at Osnabruck. Despite the presence of a baloon barrage and a heavy concentration of anti-aircraft guns, he successfully attacked his target from an altitude of 700 feet. A few nights later P/O. Swift was detailed to attack an aerodrome at Rotenburg. After waiting for forty-five minutes over the target, he carried out his attack at a low altitude and several of his bombs hit a hangar. The target was also machine gunned from a height of 500 feet and, in addition, two trains just south of the target were subjected to this form of attack.

Flt. Lt. A. T. Williams (now missing), Act. Flt. Lt. J. M. Hewson, F/O. H. F. G. Ede (now missing), P/O. J. S. Booth, P/O. L. R. Jacobsen (now missing), P/O. W. E. V. Malins, P/O. G. K. Scott, P/O. R. M. Taylor, P/O. C. B. Temlett.

P/O. J. C. Freeborn. This officer has taken part in nearly all offensive patrols carried out by his squadron, including operations over the Low Countries and Dunkirk, and more recently engagements over the Channel and South-East England. During this period of intensive air warfare he has destroyed four enemy aircraft. His high courage and exceptional abilities as a leader have materially contributed to the notable successes and high standard of efficiency maintained by his squadron.

P/O. D. G. Gribble. Since the outbreak of war this young officer has taken part in most of the offensive patrols carried out by his squadron, including operations over the Low Countries and Dunkirk, and intensive air fighting over the Channel. P/O. Gribble has led his section, and recently his flight, in a courageous and determined manner. On one offensive patrol, having expended his ammunition, he did not hesitate to lead two other pilots of his section, under severe cross-fire, in an attack against a formation of six Dornier 17s. As a result the effective bombing of an important convoy was prevented. This officer has personally destroyed three Messerschmitt 109s and damaged many others.

Sq. Ldr. J. R. A. Peel. This officer's outstanding quality as a leader has raised the flying standard and morale of his squadron to the highest pitch, and in recent actions he has destroyed at least two enemy aircraft. On one occasion, although his aircraft had been badly damaged in action, he followed and shot down a Dornier 17 25 miles from the coast and eventually had to abandon his own aircraft over the sea. He was picked up by a lifeboat when on the verge of losing consciousness, but was again leading his squadson the next morning.

Act. Flt. Lt. J. Ellis. This officer was employed on offensive patrols over Dunkirk during the evacuation of the British Expeditionary Force, and led his flight with great courage. On two occasions, whilst deputising for his Commanding Officer, he led a patrol of four squadrons and displayed great initiative and leadership. During these patrols Flt. Lt. Ellis destroyed two enemy aircraft. Later, whilst engaged on home defence duties, he shot down one enemy bomber. Recently, whilst leading the squadron, he destroyed two enemy aircraft, and on the following day shot down a further three of eight enemy aircraft destroyed by his squadron. Flt. Lt. Ellis has displayed courage and leadership of a high order.

F/O. A. J. O. Jeffrey—now reported missing. This officer has displayed gallantry and skill in engagements gainst the enemy. He destroyed three enemy aircraft in air combat, and on two occasions carried out attacks on enemy bases, destroying at least four aircraft on the ground.

F/O. N. Williams, Royal New Zealand Air Force. F/O. Williams was captain of an aircraft which was attacked by three enemy aircraft while returning from the Ruhr in July, 1940. One and possibly two of the enemy were shot down, and the third driven off. Although his aircraft was riddled with bullets F/O. Williams successfully brought it back to its base. He has taken part in 21 attacks on Germany and occupied countries since the beginning of the year, and has displayed coolness, courage and real leadership.

P/O. A. Robson. This officer showed conspicuous courage when carrying out a bombing attack on warships at Wilhelmshaven in July. Undeterred by terrific enemy gunfire, he swept down to 20 feet above the buildings, crossed the harbour and pressed home his attack on an enemy warship.

P/O. W. F. Tudhope. This officer was captain of an aircraft which was badly hit by a high explosive shell during an attack on enemy warships at Wilhelmshaven in July. In spite of this a second attack was attempted. The engine was badly damaged, but the aircraft was brought safely home.

Bar to Distinguished Flying Medal.

Flt. Sgt. W. H. Franklin, D.F.M. Since May 22 this airman has shot down 10 enemy aircraft and assisted in destroying a further two. Twice during these engagements he shot down two Messerschmitt 109s in one sortie. On another occasion, after chasing a Messerschmitt across the Channel to Calais, he encountered seven enemy fighters, five of which he engaged, destroying one of them. His skill, courage, and determination are of the highest order.

Awarded the Distinguished Flying Medal.

Sgt. W. Stockport, Sgt. L. S. Belton, Sgt. S. B. Fuller, Sgt. A. C. Goulder, Sgt. L. A. White.

Sgt. Stockport was wireless operator air gunner in P/O. Robson's aircraft at Wilhelmshaven, and fired continuously at the enemy defences.

Sgt. Belton was navigator and bomb aimer in P/O. Tudhope's aircraft. He continued his duties with great coolness and courage after his cabin had been riddled with holes, and enabled the Pilot Officer to bring the aircraft home.

Sgt. Fuller and Sgt. Goulder were captain and wireless operator air gunner of an aircraft engaged in the attack on warships at Wilhelmshaven. The attack was delivered from a few feet above the docks These airmen have invariably shown conspicuous courage and devotion to duty.

Sgt. White showed a high degree of skill, clear thinking and quick judgment as rear gunner of an aircraft attacked by three enemy aircraft over the Aerodrome at Wessel in July. Two of the enemy were sent down out of control and the third flew away

Sgt. H. H. Kitchener, L.A/C. C. J. W. Evans, A/C.2 C. C. Cleland.

The above awards are for gallantry and devotion to duty in the execution of air operations.

London Gazette

ROYAL AIR FORCE.

General Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Flight Sergeants: (June 24, Sen. April 25) J. S. Robinson; (July 9, Sen. May 2) J. A. Cant. Sergeants: (June 20, Sen. May 2) B. B. W. Howe; (July 3, Sen. June 12) E. A. Reeman; (July 19, Sen. April 25) E. S. Humphreys; (July 20, Sen. April 25) C. Logan. Leading Aircraftmen: (May 30, Sen. February 21) L. Lewington, T. McK. Mitchell.

The short service commission of P/O. on probation R. C. Miller is terminated on the cessation of duty. (July 24.)

Erratum.

In the Gazette of July 16. Notification concerning L.A/C. W. J. Beeston (44222) should have appeared under the heading R.A.F. instead of R.A.F.V.R., and his personal number as Pilot Officer is as now stated.

Technical Branch.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers on probation:—Warrant Officers: (July 17, Sen. May 23) J. L. Thrussell; (July 17, Sen. July 4) H. Horton; (July 21, Sen. March 14) A. E. Foreman.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Warrant Officers: (July 18, Sen. July 4) L. J. Strevens, D.F.M. Flight Sergeants: (July 6, Sen. May 16) H. D. Gaite; (July 17, Sen. July 3) J. M. Arthur; (July 18, Sen. May 16) V. A. Gittins, K. G. Major. Sergeants: (June 11, Sen. May 30) J. Facer; (July 15, Sen. May 16) R. A. Prew.

Erratum.

In the Gazette of July 16. Notification concerning W/O. S. C. Roach should have appeared under the heading Administrative and Special Duties instead of Technical Branch.

ROYAL INVESTITURE: Wing Cdr. Lord Willoughby de Broke, M.C., with his aunt, the Hon. Mrs. Basil Hanbury, leaving Buckingham Palace after receiving the A.F.C.

Administrative and Special Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers on probation:—Warrant Officers: (May 22, Sen. May 2) J. Addison; (May 28, Sen. May 2) B. F. Knight; (July 3, Sen. May 2) A. L. Martin; (July 17, Sen. May 30) H. C. Westwood.

The undermentioned are ganterd commissions for the duration of hostilities as Pilot Officers on probation:—Flight Sergeants: (July 15, Sen. April 25) T. D. Atkinson, M.C.; (July 17, Sen. May 30) S. J. Hargrave; (July 18, Sen. May 16) F. R. Rance; (July 22, Sen. July 3) R. B. Greenbow.

Equipment Branch.

P/O. on probation F. A. Buckingham is confirmed in his appointment. (April 3.)

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(July 5) P. L. Hancox; (July 31) C. E. Bradley, A. S. Jesson, K. W. Lawrence, S. McGinn, K. F. Mackenzie; (August 3) F. A. Buckingham.

Accountant Branch.

Sgt. J. R. Simpson is granted a commission for the duration of hostilities as Pilot Officer on probation (July 22, Sen. June 20).

The undermentioned Act. Pilot Officers on probation are graded as Pilot Officers on probation:—(June 21) G. F. H. Armson, M. V. Baxter, J. C. Boyce, D. V. C. Burgess; (June 29) A. W. Garnett, A. D. Goodliffe, J. R. Robertson, A. W. Shand, S. Shield, J. E. Simpson; (July 1) J. M. Bailey, S. Beaumont-Smith, H. Eason, R. W. Goodburn, J. F. Humphreys, G. A. Puzey.

The undermentioned are granted permanent commissions as Pilot Officers on probation:—(July 14) J. G. Brown, J. A. J. Davey, G. N. Dawson, J. F. D. Elkington, A. M. Phillips, W. C. Watling, A. R. Watson; (July 21) F. R. Casement, M. I. Cox, B. P. Erskine, P. Garrard, H. G. Gilbert, J. G. Haigh, E. Jackson, H. A. Jenkins, N. M. Maynard, P. H. H. Pritchard, P. A. Tomlinson, W. D. Whatley, T. R. N. Wheatley-Smith.

2nd Lt. H. Corbett-Wilson, R. Sussex R., is granted a temporary commission as Pilot Officer on being employed with the R.A.F. (July 8.)

The undermentioned Pilot Officers on probation are confirmed in their appointments:—(February 6) C. H. Hight; (March 6) W. D. Allies; (March 27) P. S. Handley; (April 24) I. A. Morrin; (June 6) J. R. Urwinn-Mann, P. A. Willatt; (June 13) G. J. Bell; (July 8) I. H. Cosby; (July 18) A. C. Lawson.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(June 28) J. C. Richards, G. K. Buckingham; (July 6) A. G. Malan, D.F.C.; (July 25) A. Gadd; (July 28) H. M. Hammond, J. S. Scott.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—(September 25, 1939, Sen. December 25, 1938) C. M. M. Grece; (December 19, 1939) A. D. Phillips; (May 1) P. E. Dundee; (May 16) R. M. S. Rayner; (May 28) K. W. Tait; (June 17) S. B. Grant, P. A. Major, B. H. Way; (June 27) P. C. B. St. John; (June 29) D. H. Grice, D.F.C., W. C. Turner; (July 6) J. R. M. Stewart; (July 17) N. A. Burt; (July 25) W. P. Heath, D. B. Barnard, R. Beer, R. F. Smythe; (July 29) A. F. M. Maclean; (July 30) R. V. Warren.

Air Comdre. F. G. D. Hards, C.B.E., D.S.C., D.F.C., is granted the acting rank of Air Vice-Marshal. (May 11.) (Substituted for notification in the Gazette of June 11.)

Wing Cdr. E. Thornton (since promoted) is transferred to the Technical Branch. (April 24.) (Substituted for notification in Gazette of June 25.)

Flt. Lt. K. J. Mellor ceases to be seconded for special duty. (June 26.)

P/O. T. D. Welsh takes rank and precedence as if his appointment as Pilot Officer bore date February 6. Reduction to take effect from July 12.

P/O. W. J. Thompson takes rank and precedence as if his appointment as Pilot Officer bore date June 4, 1939. Reduction to take effect from July 13.

Air Comdre. Sir O. Swann, K.C.B., C.B.E., reverts to the Retired List July 20, and resumes with effect from that date the rank of Air Vice-Marshal (Sen. June 30, 1922).

The undermentioned Pilot Officers relinquish their temporary commissions on return to Army duty. (May 15):—J. Fothergill, 2nd Lt., R.A.; H. Corbett-Wilson, 2nd Lt., R. Sussex R.

Act. P/O. on probation P. B. Verver relinquishes his short service commission on appointment to a commission in the R.A.F.V.R. (July 15.)

Medical Branch.

W/O. J. Malone is granted a commission for the duration of hostilities as Quartermaster and Flying Officer on probation. (July 15, Sen. June 20).

Group Capt. R. A. Playne, D.S.O., M.B., B.A., reverts to the Retired List and resumes the rank of Air Comdre. (March 23.)

Princess Mary's Royal Air Force Nursing Service

The undermentioned Staff Nurses are promoted to the rank of Sister:—(July 3) Miss M. F. Giles; (July 4) Miss K. Hardy; (July 17) Miss E. M. Pikesley; (July 24) Miss B. Slader; (July 31) Miss K. Smith, Miss M. E. Hale; (August 1) Miss L. M. Murdoch-Brown; (August 4) Miss K. F. Niblock.

SERVICE AVIATION (CONTINUED)

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

The undermentioned are granted commissions in class CC in the ranks stated:—Squadron Leader: (April 16) Maj. S. G. S. Skene, S.U.L., I.A. Flight Lieutenant: (July 11) A. P. Vlasto.

Flt. Lt. H. R. Kavanagh, M.B.E., is granted the rank of Squadron Leader. (June 2.)

F/O. N. B. Littlejohn is promoted to the rank of Flight Lieutenant. (December 7, 1939.)

F/O. J. A. Mortimer is transferred to the Administrative and Special Duties Branch. (July 26.)

ROYAL AIR FORCE VOLUNTEER RESERVE.

General Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—(July 7) N. Hart; (July) 14) L. W. Graham. Flight Sergeant: (June 18, Sen. May 2) P. C. Cox. Sergeants: (June 8) G. W. Morris; (June 15) I. R. Stephens, C. F. M. Jones; (June 18, Sen. May 2) H. G. Hubbard; (June 18) J. V. Gurteen, A. J. McGregor, S. N. Rose; (June 20, Sen. May 2) K. W. Hinds; (June 29) C. C. Johnston, C. W. Parish, J. Wright, R. Baker; (July 2, Sen. April 1) J. A. M. Reid; (July 6) G. B. Potter, R. S. Day, R. S. Jameson, K. G. Smith, P. J. Spink, J. Watt; (July 13, Sen. July 11) S. R. Bevan-John, M. W. Lishman, S. G. Nunn; (July 20, Sen. July 11) J. E. Holland. Leading Aircraftmen: (June 16) J. L. W. Wagland, L. C. McConnell; (July 14) M. P. Griffiths.

The undermentioned are granted commissions for the duration of hostilities as Acting Pilot Officers on probation:—(March 15) A. Lammer; (July 2) A. H. Dutton; (July 6) S. Carlin; (July 15) P. B. Verver.

The undermentioned Pilot Officers on probation are confirmed in their appointments. (Mar. 29):—R. C. Hockey, R. D. McLaren, K. N. T. Lee, A. F. Martindale, I. R. Batchelor, D. G. Johnson.

The undermentioned Act. Pilot Officers on probation are graded as Pilot Officers on probation:—(June 15) W. R. Moore, F. C. A. Lanning, V. B. Lintott.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—(June 27) P. G. Agnew; (July 10) F. B. Wright.

F/O. P. L. Shinnie is transferred to the Administrative and Special Duties Branch. (July 15.)

The undermentioned Act. Pilot Officers on probation are transferred to the Administrative and Special Duties Branch and regraded as Pilot Officers on probation:—(July 9) W. P. Pratt; (July 18) H. R. J. Adams.

P/O. R. Boyfield resigns his commission. (June 26.)

The commissions of the undermentioned Pilot Officers on probation are terminated on cessation of duty:—(July 15) J. J. Pickburn; (July 25) M. W. Nairne.

The notification in the Gazette of July 23 concerning the undermentioned Pilot Officers is cancelled:—H. H. Crawford, J. T. Davison, W. J. Finlayson, A. D. Greer, H. M. Hoadley, D. M. Poynter, J. S. Priestley, W. G. Raphael, G. D. Sise, A. S. Anderson, H. R. Hall, E. W. G. McKenzie, J. McKenzie, W. D. Brown.

Balloon Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Corporals: (July 3, Sen. June 25) F. L. Green, W. G. Larman, J. D. Odell, L. A. Smith, K. L. Thorne; (July 4, Sen. February 15) E. P. Butler; (July 12, Sen. June 24) S. David-Parkes; (July 14, Sen. June 27) N. F. Downing; (July 16, Sen. June 27) J. M. Mitchell; (July 18, Sen. June 27) J. L. Crook. Leading Aircraftmen: (July 3, Sen. June 25) A. H. Collyer, E. G. Langford; (July 15) C. L. D. Guy. Aircraftmen 1st Class: (July 3, Sen. June 25) H. W. Dawson, E. G. B. Mawer, L. G. C. Sims. Aircraftmen 2nd Class: (June 29, Sen. June 24) S. E. Gateley.

Administrative and Special Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Flight Lieutenants:—(June 1, Sen. September 3, 1939) B. W. T. Hare; (July 24) Lt. A. J. H. Dempster, M.C. (R.A.R.O.).

W/O. G. Brown is granted a commission for the duration of hostilities as Flying Officer on probation. (May 2, Sen. March 7.)

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—(April 19) E. R. Harley; (May 31) W. Thorp, Junr.; (June 1) T. F. D. Rose; (June 3) J. A. Broughton-Trower; (June 10) S. W. Jarvis; (June 17) S. C. Barber; (June 20) W. E. Davies; (June 25) R. A. Coleman, H. E. Horsfield; (June 26) E. A. Beachcroft, J. W. Higgins; (June 27) K. J. Beardwood, C. W. Christie, V. A. Creedon, H. Daly, G. C. Gibson, J. Judd, H. V. Lilley, W. Oxlade; (June 28) A. S. Allberry, A. E. H. Banister, J. N. Biggs-Davison, H. G. Knight, J. A. Longmire, H. Medhurst, A. Roberts, D. E. Roberts, R. S. Wray; (June 29) C. P. Denby, T. Harper, R. L. Hartley, A. W. Morris, K. G. Scott-Ross, W. W. Winlaw; (June 30) A. M. Forteath, K. G. Furley, W. N. Roberts; (July 1) F. G. Ferris, C. B. Jones, J. Lester, J. R. Mullings, J. G. North-Bomford, P. E. Richards, B. F. Whiteley; (July 2) O. H. Cockrill, G. P. Cuscaden, R. R. Davies, F. D. Greenwood, C. W. Mallinson, G. A. Openshaw, G. T. L. Spencer; (July 3) E. H. Arkwright, S. E. May; (July 4) C. B. L. Fitzgerald, L. G. Higgs, C. S. Wagstaff; (July 5) G. Ackroyd, E. N. Driver, W. G. Gow, J. T. Kemp, V. D. Maclachlan; (July 8) J. R. Butler, E. F. Dadson, G. H. F. Knight; (July 9) F. R. E. Clark, N. F. W. H. D'Arcy, H. E. Nixon, S. L. Thomson, J. L. Ward; (July 10) H. M. Calvert; (July 11) H. H. Norris, B. A. Walkerdine; (July 12) K. Barker, F. E. Chinnery, A. D. Evans, W. J. Evans, W. G. Hasler, F. V. Jobling, C. T. Luker, C. E. Mackrieli, C. H. Waghorn, E. T. Webster; (July 13) R. W. Hanner, E. H. Hobday, R. E. K. Pembrook, E. Ross-Hime, R. Souray, T. O. D. Steel; (July 14) W. L. Booty; (July 15) E. T. S. Byass, R. C. Clifford-Turner, S. H. Garside, F. P. Grant, F. W. Hudson, D.F.C., M. S. McCorquodale, M.P., C. H. Ogden, R. Park, J. D. Paul, C. R. E. Pope, H. R. J. Sprinks; (July 16) C. W. S. Chalmers, D'A. Clark, A. C. Gray, J. W. Limmer, L. S. Symons, W. E. Witcher; (July 17) I. C. Alexander, L. C. Bovell-Jones, J. A. W. Brooker, G. W. Butcher, R. H. Cook, L. Creery, A. F. H. Crust, E. A. Davis, L. W. Duncan, E. L. Eldridge, R. H. Finch, F. N. La F. Flint, C. G. H. Galloway, G. W. Gilbert, F. W. Goldie, C. W. Hart, G. T. Heard, L. O. Hockey, S. G. G. Humphreys, R. D. Hyem, P. J. Newton, C. H. Nicholson, L. L. Ogier, J. H. W. O'Kelly, H. G. H. Phipps, E. L. Relf, J. A. Richardson, E. C. Simond, F. Turnbull, T. Ure, N. W. Waddington, T. K. Waite, T. H. Wilson; (July 18) A. W. Cant, D.C.M., K. Christie, P. S. S. Clark, H. W. Cleland, J. B. Cooper-Reade, G. Grant, A. W. Higgett, C. A. Muscat, M.C., H. W. Sibley, N. A. Sligh, L. H. Smith, G. C. Sturgis, C. W. Wilkinson; (July 19) W. H. Bennett, G. R. Colegrave, B. W. Goddard, H. F. King, N. J. S. O'Brien; (July 20) M. W. B. Bladon, F. C. Burton, B. N. Cull, F. Eade, E. T. Elliott, R. P. Levy, C. G. Maby, A. L. Owen, L. B. Petley, E. G. Pinckney, J. C. M. Tucker; (July 21) C. Braby, R. H. Phillips; (July 22) A. W. Baird, A. F. C. H. Chaplin, J. C. Fitzgerald, S. A. Oades, C. E. Porter; (July 25) V. de Boursac. Sergeants: (June 27, Sen. April 25) A. P. F. Schneidau; (July 17, Sen. July 3) S. Gifford; (July 18, Sen. May 16) J. E. S. Elwell. Corporal: (July 8, Sen. June 20) W. G. Torrance.

The undermentioned are transferred to the Technical Branch:—Pilot Officers on probation: (April 24) E. W. Sergeantson. R. M. Hayes, L. F. Davies, K. C. Whitwell, G. A. E. Norris, J. D. Sumner, N. H. Terry, C. W. Lockhart, G. W. Futcher, J. Alexander, J. Singh, A. E. W. Ward, D. B. G. Miles, F. C. T. Evershed, W. W. Coates, J. M. West, F. G. T. Dudgeon, H. Karslake, C. G. James, T. F. Bullus, J. S. Steele, T. R. Hancock, S. B. Bailey, R. H. Thomas, G. Dexter, E. D. Whiting; (June 22) N. H. Strange, L. Cook, A. Boyle, M.C., A.F.C.; (June 24) P. L. Crowell, P. M. Chettle, C. F. Croisdale, C. S. Fell, E. G. Jackson, J. L. Longden, A. H. Lynall, J. E. Pipe, T. R. Robson, L. S. Wigdortchik; (June 29) R. D. Poore, C. H. Shute, H. C. Barty, W. E. French, W. Barker, H. Mundy, J. F. L. Corkett, H. J. Hart, J. Uphill, G. J. Owen, D. Lewis-Jones, H. W. Scott, M. J. Lipsey, A. P. Pearce, S. A. Cox, C. N. Prentice, S. J. D. Acland.

P/O. H. C. Martineau relinquishes his commission on appointment to a commission in the Welsh Guards (July 29).

The undermentioned relinquish their commission on account of ill-health:—Pilot Officers on probation: (July 30) S. V. Pearce; (August 1) A. J. Barraclough.

Sqn. Ldr. F. Choules relinquishes his honorary commission (July 8).

P/O. on probation S. J. Smith resigns his commission (July 27).

The undermentioned relinquish their commission on cessation of duty:—Flight Lieutenant: (July 27) M. Mackenzie, D.S.O. Pilot Officers on probation: (July 5) J. A. Broughton-Trower; (July 19) C. R. Macnamara.

Medical Branch.

The undermentioned are granted commissions for the duration of hostilities:—Squadron Leader: (July 15) N. K. Henderson, M.B., Ch.B., D.P.H., D.P.M. Flying Officers: (July 16) J. F. Bentley, M.B., B.S., M.R.C.S., L.R.C.P.; R. S. Carpenter, M.R.C.S., L.R.C.P.; C. E. Cole, M.B., B.S., M.R.C.S., L.R.C.P.; J. D. Craig, M.B., B.S., M.R.C.S., L.R.C.P.; C. A. I. Fuge, M.B., Ch.B.; C. H. George, M.R.C.S., L.R.C.P.; M. N. Phillips, M.B., Ch.B.; M. J. Greenberg, M.B., Chir., M.R.C.S., L.R.C.P.; J. M. Sword, M.B., Ch.B.; J. Whitehead, M.R.C.S., L.R.C.P.

Chaplains' Branch.

The Rev. J. Dowell is granted a commission for the duration of hostilities with the relative rank of Squadron Leader (July 16).

Women's Auxiliary Air Force

The undermentioned are appointed Assistant Section Officers on the dates stated:—(July 27) A/CW.2 Miss M. Bird, A/CW.1 Miss P. G. Blockley, Cpl. Mrs. E. R. Chadwick, A/CW.1 Miss D. M. Charlton, Cpl. Mrs. M. Corke, A/CW.2 Miss D. F. A. Cuming, A/CW.1 Mrs. D. Deall, A/CW.2 Miss G. Y. Dickinson, A/CW.2 Mrs. J. M. Edwards, A/CW.2 Miss J. Edwards, Cpl. Miss A. Ellis, A/CW.1 Miss J. M. Fawcett, Cpl. Miss A. M. Fowles, A/CW.2 Miss J. Goodman, A/CW.1 Miss J. Hancock, A/CW.1 Mrs. V. M. Hough, Cpl. Mrs. B. E. James, A/CW.2 Miss L. A. F. Kenderdine, A/CW.2 Miss M. Lea-Wilson, A/CW.2 Miss K. J. Lesley, A/CW.1 Miss M. Lindsay, A/CW.1 Miss P. A. N. MacMahon, Cpl. Miss M. C. McWatters, A/CW.1 Miss M. W. Musselwhite, A/CW.2 Miss I. R. Prideaux, A/CW.2 Miss E. B. Reid, A/CW.2 Miss P. C. Sant, A/CW.2 Miss F. L. D. Scholefield, A/CW.1 Miss K. F. Stevenson, A/CW.1 Miss O. Sutherland, A/CW.1 Miss M. Swinburne, A/CW.2 Miss H. M. Tattersall, Sgt. Miss M. L. Tillotson, A/CW.2 Miss E. Trouncer, A/CW.2 Miss E. M. Wakefield, Cpl. Miss M. L. Watkins, A/CW.2 Miss A. S. Watson, Cpl. Miss J. Willoughby-Osborne; (July 29) A/CW.1 Miss M. E. Clancey, Cpl. Mrs. P. S. Clark, A/CW.1 Miss J. L. Crichton-Miller, A/CW.1 Mrs. M. M. N. H. Embry, Sgt. Miss F. W. G. Firebrace, Sgt. Miss H. L. M. Gibbs, A/CW.2 Miss K. H. Gill, A/CW.1 Miss J. S. Hatchwell, Cpl. Miss D. M. Hebbert, A/CW.2 Miss J. M. Isemonger, A/CW.2 Miss P. Jerrard, A/CW.1, Mrs. M. A. Jones, Sgt. Miss S. L. Jones, Sgt. Mrs. J. Marlow, A/CW.2 Mrs. E. M. Shippard, Cpl. Miss A. M. Stewart, Sgt. Miss S. M. Swinburne, Sen. Sgt. Mrs. E. M. Weightman, Sgt. Miss A. K. J. Wilde.

AS THE WELLINGTON IS TO THE HEINKEL: Members of the Observer Corps putting their spare time to profit by studying the differences between representative British and enemy aircraft types.

THE INDUSTRY

A special Prestcold low-temperature refrigerator installed in one of our aircraft factories.

Long Service

AN interesting ceremony took place at the premises of Messrs. Butlers, Ltd., the well-known aircraft lamp and motor accessory manufacturers, "Atlantic" Works, Small Heath, upon the occasion of the presentation of eight gold watches to employees who have completed twenty-one years' service with the company.

The presentations were made by the Managing Director, Mr. J. C. T. Blake, who also presided at the ceremony which followed of a free distribution, by means of a selecting drum, of a number of War Savings Certificates, in connection with their National Savings Group.

Prestcold Refrigerator

PERHAPS one of the most useful functions of low-temperature refrigeration is its employment in connection with shrink fits. In modern engineering, much use is made of interference fits for mechanical fixation of parts such as bushes, liners or inserts in main assemblies and to provide either liquid- or gas-tight joints between parts. In many applications it is only necessary to heat the one part and press or screw into it the other. There are, however, a number of applications arising where high temperature heating of one part is impracticable, either because it affects the physical properties of the material or because it causes undesirable distortion. Further, it often happens in practice that when one part is inserted into another by high pressure, a considerable amount of metal is removed from one or both of the parts, resulting in a final interference less than that called for on the drawings. In cases such as these, the cooling to a low temperature of the piece to be inserted, coupled with the moderate heating of the main assembly, can be adopted to ensure a true final interference. In this way production is speeded up as a result of the ease with which the parts can be handled and the light pressure, if necessary at all, required for assembly. Another important consideration in many modern engineering devices is that low-temperature refrigeration enables parts to be placed in position accurately to location.

An interesting example of a special-purpose low-temperature refrigerator is illustrated. This refrigerator, installed in an important aircraft factory, is required for the continuous cooling of certain bushes to −80 deg. from room temperature, at the rate of 64 per hour. Bushes are loaded into the cylindrical coolers at the top of the cabinet and withdrawn by means of an air-sealed manual-control ejecting gear at the bottom. With this arrangement, no trouble is experienced with "icing-up" of the cooler. The withdrawing of the bushes has no effect upon the temperature of those remaining in the cooler, and further warm bushes can be loaded into the machine at the top without affecting the temperature of those awaiting withdrawal below. A number of these machines have been installed and are in production, and they have enabled considerable speed-up in production and saving in labour of assembly.

The Pressed Steel Company can supply low-temperature refrigerators for a wide range of capacities and of any type to meet the special demands of industry.

Ludlow General Manager

MR. HARRY MILNES, who, since 1938, has been general manager of Modern Machine Tools, Ltd., returns to the aircraft industry by his appointment as general manager of Ludlow Bros. (1913), Ltd., and general manager and director of Welsh Metal Industries, Ltd. He still retains his seat on the Board of Modern Machine Tools, Ltd.

Mr. Milnes was connected with the aircraft industry for many years, having served with the R.A.F. in the Great War and afterwards with the Blackburn Aircraft Co., Ltd., for a period of fourteen years.

The Nickel Bulletin

AN historical survey of the electrolytic pickling and polishing of metals, which is abstracted in the current issue of the *Nickel Bulletin*, shows that this subject has received much attention during recent years. Bright plating, another subject of wide interest, is leaving the experimental stage. Minor abstracts give a few interesting hints on the cleaning of stainless steel, and details of Monel nails, which are claimed to be superior to screws in holding power.

A.G.S. Data

MOSERS, LTD., of Liverpool and London, who hold large stocks of A.I.D. certified A.G.S. parts and who are known throughout the industry for their ingenious Moser Patent Locating Pin, have prepared a booklet of aircraft data useful to have handy in design offices. It gives in a convenient manner weights and dimensions of A.G.S. parts and aircraft steel.

Copies are to be had from either their Liverpool address at 112-114, Old Hall Street, or from 170-192, Borough High Street, London, S.E.1.

NEW COMPANIES

LANCASHIRE AIRCRAFT CORPORATION, LTD.—Registered as a "private" company on July 20, with a nominal capital of £100 in 100 shares of £1 each. The objects are: To carry on the business of manufacturers of and dealers in aeroplanes, seaplanes, gliders, balloons and parachutes, motor cars, motor and other cycles, launches and boats, internal combustion engines, etc. The directors are: Ernest Walton, Verwood, Ightenhill Park, Burnley, cotton manufacturer, and Harold Bolas, Swandean Corner, Salvington Hill, Worthing, aeronautical engineer.

AERONAUTICAL PATENT SPECIFICATIONS

(Published May 23, 1940.)

1938.

30406. CLEVELAND, F. J. (BENDIX AVIATION CORPORATION). Pressure-sensitive devices (520,411).

30601. BENDIX AVIATION CORPORATION. Securing of conductors on magnetic teeth or poles, and more particularly in dynamo-electric machines (520,418).

31020. KINGSTON, P. F. Lifting-rotor for aeronautical purposes (520,509).

3143/ BAYERISCHE MOTOREN WERKE. AKT.-GES. Disposition of engines in aircraft (520,457).

33189. STANDARD TELEPHONES AND CABLES, LTD. (MATERIEL TELEPHONIQUE SOC. ANON.). Radio direction-finders (520,606).

(Published May 30, 1940.)

1938.

31082. COWEY, L. E. Tail wheels for aircraft (520,648).

31274. ARGUS MOTOREN GES. Charge-forming devices for internal-combustion engines, especially aircraft engines (520,705).

31609. CUNLIFFE-OWEN AIRCRAFT, LTD., and FOWLER, L. J. P. Gun mountings, more particularly intended for aircraft (520,848).

31750. BECKETT, LAYCOCK AND WATKINSON, LTD., and WATKINSON, A. Windows for aircraft (520,793).

31753. BRITISH AIRWAYS, LTD., *and* MCMILLAN, A. R. O. Pre-flight plan and navigation log for use in aerial navigation (520,865).

(Published June 6, 1940.)

1938.

27188. DOWTY, G. H. Retractable undercarriages for aircraft (520,994)

27190. DOWTY, G. H. Undercarriages and pressure-reservoirs of aircraft (520,995).

29176. BRISTOL AEROPLANE CO., LTD., and FRISE, L. G. Gun turrets for aircraft (520,884).

29178. BRISTOL AEROPLANE CO., LTD., and FRISE, L. G. Gun turrets for aircraft (520,885).

31775. DOWTY, G. H. Resilient wheel mountings for aircraft undercarriages (520,944).

31891. KOLLSMAN, P. Drag tachometers or rate-of-motion indicators (520,904).

31898. DORNIER-WERKE GES., and DORNIER, C. Structural members, more particularly aircraft spars or beams or girders (520,945).

31937. WEBLEY AND SCOTT, LTD., and SMALLWOOD, H. W. Use of signal pistols on aircraft and other rapidly-moving vehicles (520,920).

31944. KING, F. W. Aircraft (520,948).

32241. ALGARSSON, G. Synchronising mechanism for multi-engined aircraft (521,000).

32261. KORT, L. Propulsion of air and marine craft (520,084).

32305. HARWOOD, D. Aircraft fitted with lifting-screws (521,102).

1940.

991. CASSVAN, M Parachute (521,033).

(Published June 13, 1940.)

1938.

27565. BLACKBURN AIRCRAFT, LTD., and STIEGER, H. J. Wing flaps of aircraft (521,100).

28966. TRIGGS, W. W. (AKT.-GES. BROWN, BOVERIE & CIE.). Wind tunnels (521,143).

32737. KINDELBERGER, J. H. Machine gun mountings for use on aircraft (521,205).

32738. BOWEN, R., and TORRESEN, C. T. Signal pistol mountings for use on aircraft (521,272).

32938. AVIMO, LTD., and STEVENS, H. C. M. Apparatus for measuring air flow (521,294).

32958. CHEESMAN, R. S. Helicopters (521,218).

32963. DOWTY, G. H Resilient wheel mountings for undercarriages of aircraft (521,212).